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PC GRAPHICS FEATURE

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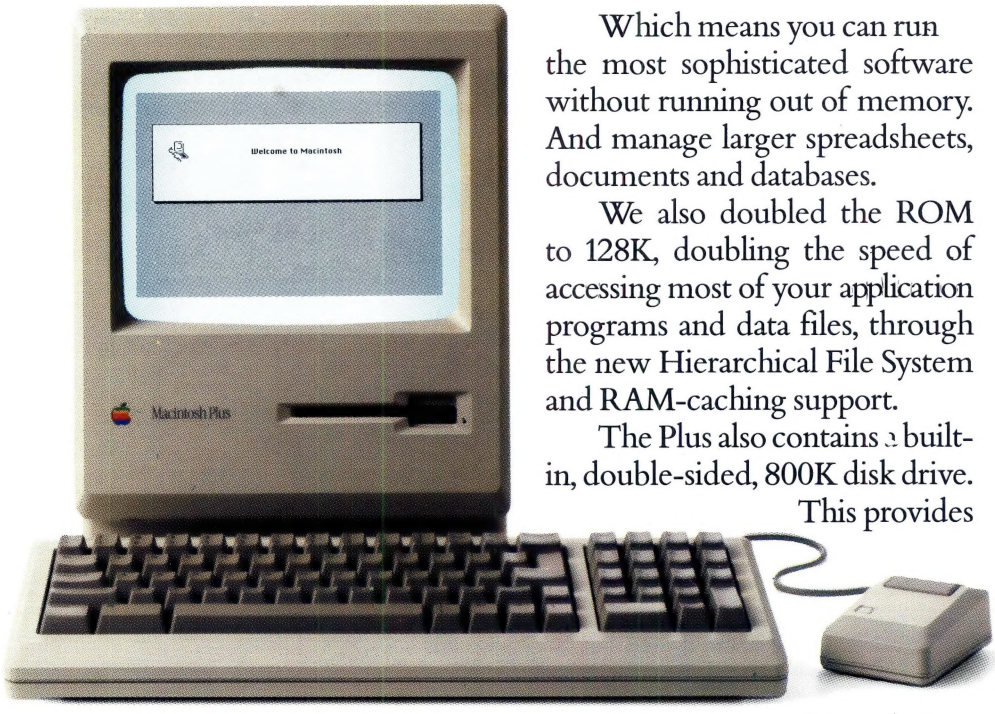
AUSTRALIA'S TOP SELLING COMPUTER MAGAZINE

NEC STEPS INTO LINE

'Go-it-alone' policy abandoned on APC IV

New Macintosh Plus. We've added



This year Apple introduces a new Macintosh.

Macintosh Plus.

As the name suggests, it's evolutionary, rather than revolutionary

(It's not our policy to bring out totally new computers for the sake of it. Instead we strive to perfect existing ones.)

Macintosh Plus is as simple to learn and use as before.

But there are some big differences, encouraged, we don't mind admitting, by current Macintosh owners.

Some of you asked for more power, others speed. Some needed greater storage capacity, others expandability.

Some heavy number-crunchers wanted a numeric key pad and conventional cursor keys built into the keyboard rather than remote.

Done. Done. And done.

The pluses of this new Macintosh include a full megabyte of RAM (expandable to four megabytes).

Which means you can run the most sophisticated software without running out of memory. And manage larger spreadsheets, documents and databases.

We also doubled the ROM to 128K, doubling the speed of accessing most of your application programs and data files, through the new Hierarchical File System and RAM-caching support.

The Plus also contains a built-in, double-sided, 800K disk drive. This provides twice the capacity of the previous Macintosh and the equivalent of 400 typed pages, or a bulging file drawer.

If that's still not enough, you can always plug in another 800K external drive.

Or you can really go all out and add our new Hard Disk 20.

(Its 20 megabytes are about 10,000 pages worth.)

Just plug in a Macintosh Hard Disk 20 and you can keep all your software, files, worksheets and documents within a moment's notice of your screen.

Add the Apple program Switcher, and you can actually work with several applications at once, moving information from one into another with the greatest of ease.

So you can transfer notes from an outline to a report – or numbers from a data file to a spreadsheet – as fast as you can click your mouse.

AppleCare.

All Apple products come with an automatic 3-month warranty covering all parts and labour.

But this year, Apple introduced a sort of "Warranty Plus" through the AppleCare service programme.

If you fill out and mail to us the registration form enclosed with your equipment, you will receive nine extra months' cover on top of the normal three.

Macintosh Plus also features a new SCSI connection port (dubbed "Scuzzy" in typical fashion by the development team).

SCSI stands for Small Computer Systems Interface and it's an industry standard.

We've virtually opened up the architecture. But what we've really done, of course, is open up a whole new world of possibilities.

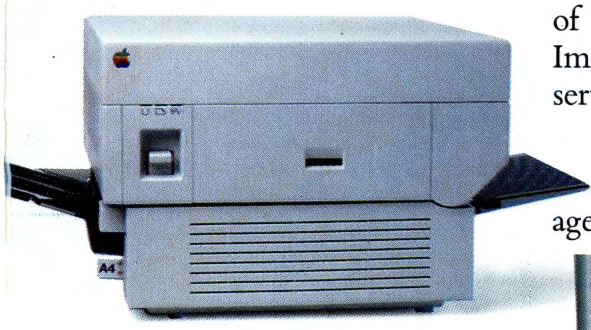
The Scuzzy port let's you daisy-chain up to seven high-performance (and often low-priced) peripherals like hard disks, file servers and tape backups from all sorts of third parties.

Given all this power, it made sense to team it with equally impressive printers.

The new LaserWriter Plus is just such, producing documents with text and graphics of publishing quality.

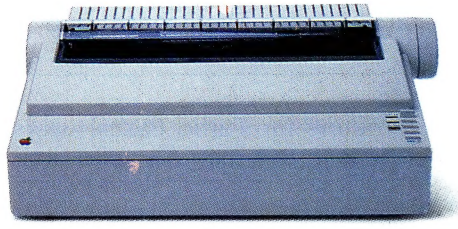
everything except complications.

And it maintains this fidelity on copy paper, letterhead, labels, envelopes or overhead transparencies.



LaserWriter Plus has 35 different typefaces built in, a choice that would embarrass your local printer (and his invoices).

But if you don't need publication-quality printing, you can have near letter-quality by teaming up your Macintosh with the ImageWriter II.



It prints in three different modes: high-quality, standard and draft. And churns it out at speeds of up to 2½ pages per minute.

You can feed in single sheets automatically with the optional SheetFeeder.

And print up to seven colours using appropriate software.

ImageWriter II can also be shared with other Macintosh users via AppleTalk.

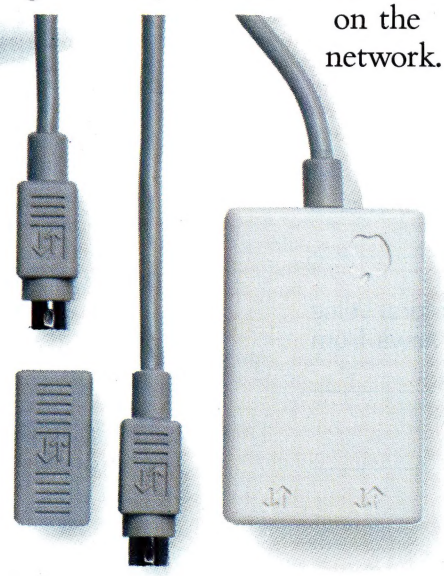
But this Macintosh isn't called Plus for nothing. You can just add and add.

Items like an AppleTalk Personal Network.

It's the most flexible, low-cost, easy-to-set-up, easy-to-use network around.

It'll connect up an office full of Macintoshes, LaserWriters, ImageWriters and file and disk servers – 32 devices in all.

Using an electronic mail package, you can send messages to any Macintosh screen on the network.



Or with EtherMac software you can share information with other computers. (Our computer is so friendly it'll even talk to IBMs.)

Add an Apple Modem 1200 to your Macintosh and you can talk to anyone virtually anywhere.

With a communications program like MacTerminal, a standard telephone and an Apple modem, your Macintosh can plug into electronic information services like Viatel, Minerva and Midas and communicate with mainframes and minicomputers.

If you already own a Macintosh, there's another plus.

You can upgrade your machine to the new one megabyte. Ask your dealer for upgrade details.

You can also upgrade your LaserWriter to become a LaserWriter Plus.

Get hands-on with the new Macintosh Plus.

You should like it.

You helped design it.

The Apple business card.

If you wish to own a Macintosh system, you can take advantage of the Apple Credit Card, available from participating dealers.

You can use it to purchase computers, peripheral equipment and software with no down-payment and less impact on your cash flow.

If you qualify, in most cases you can take your own Macintosh with you and dive straight into work with it the same day.

For an authorised Apple dealer near you outside Sydney, you call toll-free (008) 22 1555 or Sydney 908 9088. AP 219/Palace

Apple

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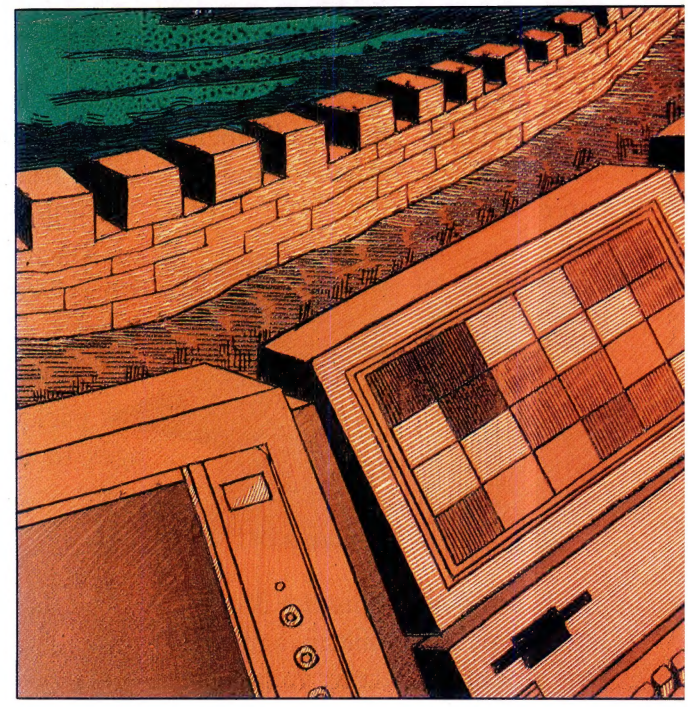
Volume 7, Number 9, September 1986



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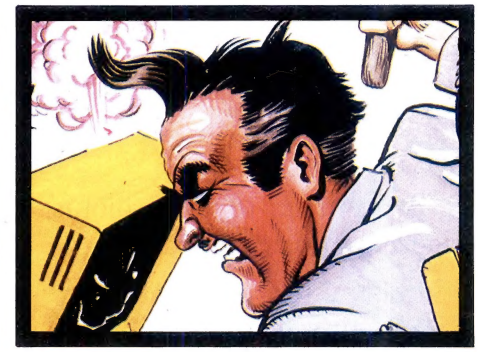

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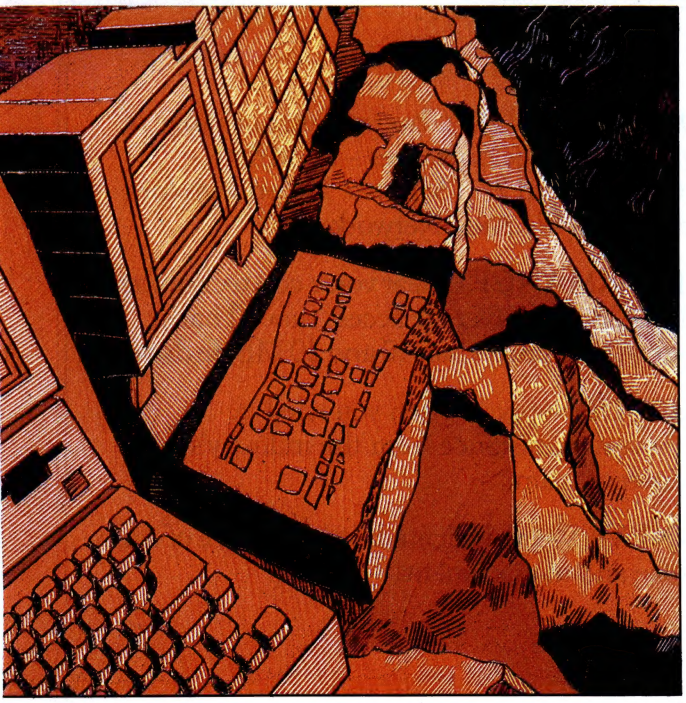

SPECIAL FEATURE

Next month, APC's *Graphics Special continues with a look at what graphics and CAD/CAM packages are available as well as surveying the monitor marketplace.*

FEATURES

BENCHTESTS & REVIEWS

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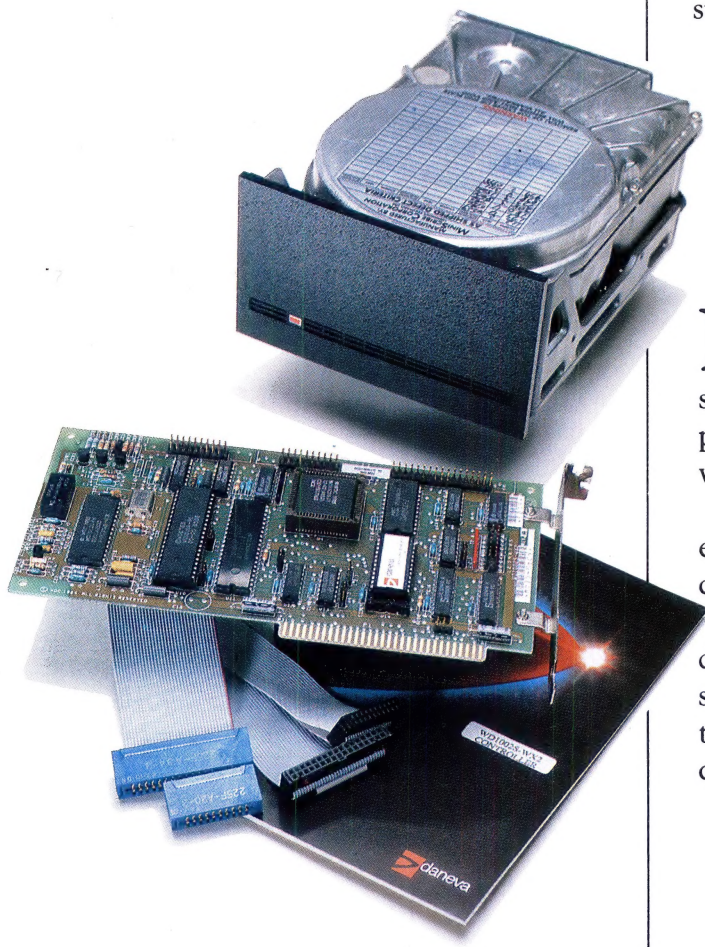

Powerful PC software like Lotus 1 2 3 [1], dBase III[2] and Symphony[1] gobbles up disk space at an incredible rate. That's why Daneva packages high performance hard disk drive kits with capacities up to 85MBytes.

Daneva kits are complete, system proven and easily installed ... no fiddling around with complex set up procedures and cryptic manuals.

That's only half the story. Daneva is developing a solid reputation for excellence in storage system hardware and software support for the whole range of IBM PC/XT, AT®[3] and their compatibles.

[1] Lotus 1.2.3. and Symphony are registered trade marks of the Lotus Development Corporation.

[2] dBase III is the trade mark of Ashton Tate.

[3] IBX PC/XT, AT® are the registered trade marks of International Business Machines.

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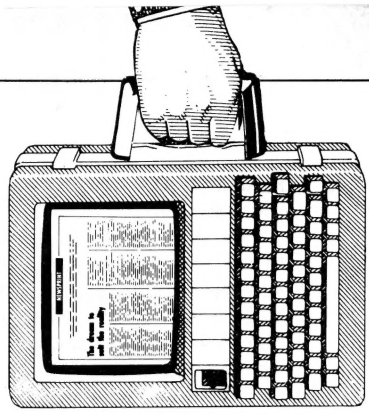


Many chips do not a sophisticated machine make, as Amstrad has proved. And, can it be true — Guy Kewney wins a software award? He reveals all in this month's news report.

Giant-sized screens

Does the future of computing lie with displays that can show bigger letters, or displays that can show more letters?

If the answer is bigger letters, then the Hercules Graphics Card Plus, with RamFont, must be a winner at $. *(See 'Checkout' elsewhere in this issue — Ed)*

Of course, it does more than simply print big characters on the screen. It also provides 25 fonts onscreen at once, so that programs like Microsoft Word, which can print out funny fonts, can now display them onscreen.

I don't get too excited about this, even though it does mean that you can do italics and Times and sans serif all at character-screen speed,together with graphics. The problem is this: the whole point of seeing fonts as they are, is to give you a good idea of what you are going to print out.

Unfortunately, the size of these fonts will not be proportional to the size as printed out, so you'll have lines not lining up. So why do it?

The big characters look nice, but they aren't what it's all about. That's my opinion. Unfortunately I have only Bill Gates, head of Microsoft, as a back-up authority for the contrary view which suggests that what users will really be grateful for is not big characters, but paper-sized screens in 'portrait' mode, rather than 'landscape' mode.

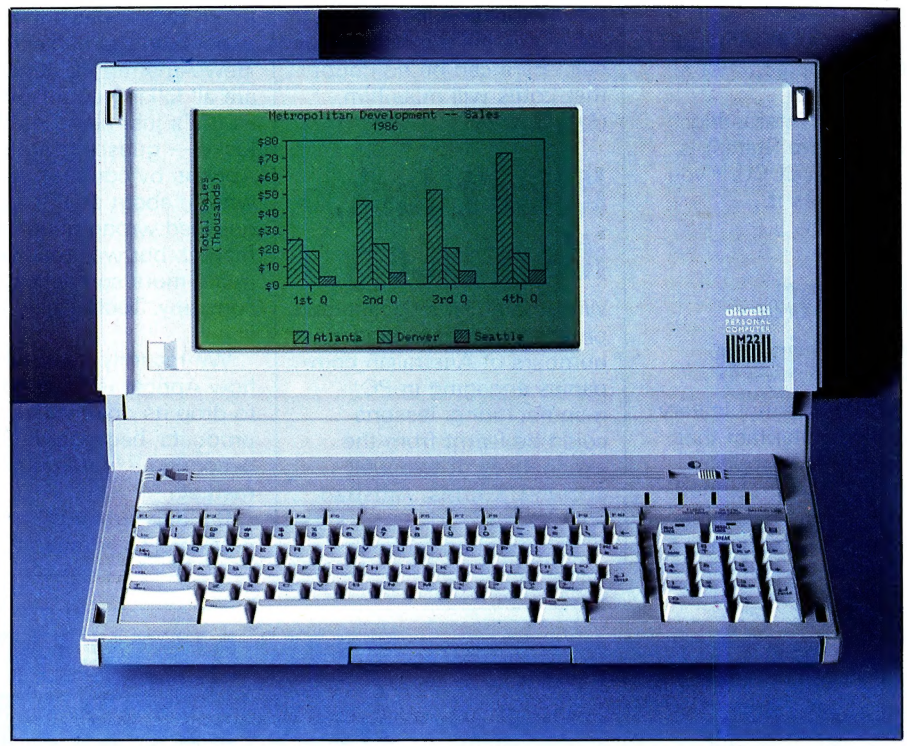
Gates is speaking from experience when he says this. He has fitted his entire office in Belle Vue, Washington, with PCs displaying their stuff on enormous portrait-style screens, showing not 25 lines, but 60 lines.

He says: 'Before, I used an electronic mail a bit. Now, we all use it a lot. There's a difference: I can read through my mail very fast, a page at a time, scanning it with my eyes in one sweep.'

The result is that Microsoft people are sending longer memos, with more facts in.

The point of having big fonts is not wasted on me. This Hercules thing has a method of varying the size of characters from four to 16 pixels high, and from eight to nine pixels wide.

The trouble is that, once you've done this on a 25-line screen, there isn't much



The Olivetti M22 lap-top PC tested in the* July *issue of* APC *will not be sold in Australia, at least with Olivetti's badge on it. The reason for its cancellation remains somewhat of a mystery, with conflicting stories from Olivetti and Chisholm, the US-based company which produced the machine. Olivetti suggested the machine did not live up to expectations and was dropped "for technical reasons", but on the other side it is alleged Olivetti only realised at a late stage that it did not have exclusive rights to the product. Olivetti then declined to market it on the basis that it might encounter unexpected competition from other companies also marketing the machine.

room for information.

Human eyes are very, very good at scanning big sheets of paper for the words they want. If there are 80 columns and 25 lines, the scan is quickly done, but the information may be on the next page, or the one after that. On a 60-line screen, you can see at once that paragraph two and paragraph seven are pretty well repetitions. And you ignore the second one: if you wrote it, you delete it; if someone else wrote it, you dismiss him as a nerd.

On a big sheet of paper, of course, the big characters are sometimes necessary. The question arises: do we need them that big onscreen?

For desktop publishing, yes. You have to see how the text fits together. Unfortunately, desktop-publishing programs seem to be imagining that they'll work on a 66-line screen, not a 25-line screen.

It could get interesting. Hercules (in the States) is on (415) 540 6000 if you want to discuss it.
Guy Kewney

Lotus on the horizon

Lotus (the company) is very relaxed about the fact that the company's founder, Mitch Kapor, has resigned from his job as chairman, and it even seems happy about his having signed no more than a one-year consultancy contract.

Mitch remains on the board of Lotus Development, and there need be no doubt that the company needs him. What isn't clear, is whether it realises how much.

I don't know Mitch well. I met him a few times before he became famous, and in those days he had the time (and the inclination) to spend time with writers like me. These days he doesn't.

But the fact remains that he is an innovator, a man with ideas (a very rich one, too), and is quite certain to come up with something new and earthshaking.

Whether he turns it into commercial success or not, is not a matter for prediction; and you can quite understand why Lotus would try not to sound panic-stricken when it had to announce his departure. But still, there can be no doubt that Lotus will miss him.
Guy Kewney

It isn't luck, it's strategy

With the dollar's decline and prospects of increasing numbers of Australian companies engaging in PC manufacturing, lessons could be learnt from the experiences of two well known UK firms: Amstrad and Apricot.

The Amstrad range is something no self-respecting technologist would touch with a barge-pole, right? Wrong!

The PCW is a very sophisticated piece of electronics. Look inside it, count the chips. Not a lot, are there? That doesn't make it simple. Are you nuts? That's what makes it clever.

Saying the Amstrad has 'only' a dozen chips is like saying it took Steve Crab 'only' three and three-quarter minutes to run a mile. *Anybody* can do it in 10 minutes.

The number of chips inside the average IBM PC is a tribute to the amount of money people are prepared to pay for it, not to its cleverness.

Why the angry sermon, Guy (mutters the *APC* editor)?

Answer: I've been reading micro magazines,and newspapers, on the subject of the 'new Amstrad PC', and they are all talking about Amstrad as if it's just being pretty lucky — guessing right. Apricot, by contrast, is being written about as if it had just guessed wrong about the market, but was really a very much more sophisticated company. Technically, that is.

We recently heard about how Apricot is 'obliged to drop its down-market products' because that is becoming a 'commodity market'.

By 'down-market' products, they mean the Rascals, the F series and the Portable.

These products went into *exactly* the same market that Amstrad is now supposed to be looking at with its new machine — the business market under $2000.

So why are the British selling Apricot shares and buying Amstrad shares, if what Apricot is doing is clever and what Amstrad is doing is silly?

The difference is simple. Amstrad (based on past record) will succeed in producing something under $2000, on which the company will make an unhealthily large profit. And it will work. Apricot, by contrast, never planned to do what it ended up doing.

Apricot started out importing games software for the Pet. Then it started selling business software (written by the company) for the Pet. Then it bought Pet-alike CompuThink machines from the States, to run that software faster.

Thus it expanded, by buying a bigger, faster machine (the Sirius) from the States. Just before Sirius crashed, it started building the thing in Scotland. And just before the Sirius market fell apart, it created a new Apricot market by producing a Sirius lookalike which was smaller and prettier.

There was no long-term planning involved, just the company leaping out of danger before the trees fell on it. And worse, in my

LOST SOMETHING?

"I CAN'T find that bit of paper with his address on it?"
"That *HOT* prospect's name and number is *GONE*!"
"Has it been *THAT LONG* since I called you last?"
"Was I supposed to send that yesterday?"
"What were we talking about last time?"
"You're John *WHO* from *WHERE?*"

"You want ME to type HOW MANY labels and letters?!?!"

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opinion, was the fact that Apricot made machines that theoretically should have worked, but somehow never really did. More important, despite its reasonable success in Australia, it couldn't get people to buy them in large quantities, and so the profits were small.

Amstrad took its PCW range and aimed it very clearly at a market — people who wanted a computer for word processing, at a very low price. If Apricot could have built such a thing, it would have. The company looked at the idea, and dismissed it as impossible.

If Amstrad does launch a PC, then there are obvious questions that need to be asked. Will it run DOS? Is it at least as compatible as an Olivetti M24? What about plug-in cards? Copy-protected disks — will they work? And so on.

But nobody (with the exception of one or two hopelessly ignorant nerds) is thinking of asking whether Amstrad can produce the machine for the price, at a profit.

Guy Kewney

This man, Kim Sadlier, was very serious two years ago about his concept of multi-directional program flow, embodied in his product 'Friend'. He convinced others to enthuse about Friend too; he managed to float his company, Sadlier Computer Research which owned Friend, onto the second board of the Perth Stock Exchange; and he made a handsome profit out of all of this.

Things aren't so rosy now, though, but before elaborating it is relevant to note that Sadlier's prospectus contained independent assessments of Friend from 'experts', all glowing with enthusiasm for the product's future.

Sadlier recently lost control of Sadlier Computer Research and the new management decided to revalue Friend. It is now, in the eyes of the management, a piece of worthless junk. Harsh words? We don't think so. Friend's book value now stands at one dollar, down from $8 million. The directors of the company hope to change its name (who wouldn't) and employ themselves as investors of what remains (about $3 million) of the money extracted from the public through Sadlier's float. This is not as wicked as it may appear, as the company now has in its 'favour' massive tax losses which can be carried forward and offset against future investment profits.

Kim Sadlier accuses that the new management "progressively dismantled and ruined the product to the point where it is valueless".

Where Kim Sadlier went wrong was that he left himself wide open to being unseated when he kept only 19.9 per cent of Sadlier Computer Research when he floated, pocketing a handsome amount from his other shares.

So Friend is worthless; the public has done its money; Kim Sadlier hasn't done too badly; and 'experts' have, well, done their credibility.

Here's a flash of brilliance: Kim, ring that nasty new management, and offer them $2.50 for Friend — they'd have to sell!

A profit (and 250 per cent at that) is a step in the right direction for Sadlier Computer Research.

Million-dollar guy

Guess what! I've won a Five Million Dollar Software Award!

I know I have, in the past, been rude about micro awards of the kind promoted by this august magazine. Awards (I have argued) are simply a way to promote magazines, and shouldn't be taken seriously by the industry.

Naturally, my publisher has not altogether agreed with me. Neither have people in the industry who have won awards been grateful for my suggestion that they'd be lucky to survive them.

However, I have argued that what really matters is sales, not awards, and so Geoff Reiss, head of Abtex, was very excited to win an ICP Million Dollar Award for his Pertmaster program a year ago. 'This should please you, because it's based on sales,' he told me happily.

I am a horrible, negative person. I laughed. 'Who came around to measure your sales?' I asked.

So this year, Geoff decided to settle the matter once and for all. Enlisting me as his accomplice, he created a new software company, Consoft. It invented a program, D.B.X.V. (the purpose of which we can't remember; I think it was a mainframe communications product, Geoff thinks it was a database) and filled in the ICP Awards form with this totally spurious information. We said it had sold over $5 million worth in 12 months.

ICP wrote back to Consoft (did the name really not suggest caution?) and said: 'Congratulations! You've won an Award. Send a cheque to cover the plaque and the awards dinner, and come along.'

We didn't go. Geoff is well-known in the business. I have my photo printed here and there, too, and it occurred to us that we might not be welcome, posing as Stephen Adamson and Simon Aliss, directors of Consoft.

It turns out that you don't have to go to the dinner. It costs nearly $500 for two, and you have to send at least one person to collect the plaque. But if you can't go, then the plaque alone costs a mere $100.

Consoft doesn't have a cheque book. So Mr Aliss (or was it Mr Adamson) went out and bought $100 worth of postal orders — the cost of which will have to be fought over between Messrs Kewney and Reiss — and sent them to ICP.

I now have a handsome, wood-mounted iron or aluminium (can't really be sure which) plaque, which drones on about how D.B.X.V. (correctly spelled, with full stops) 'having clearly evidenced its

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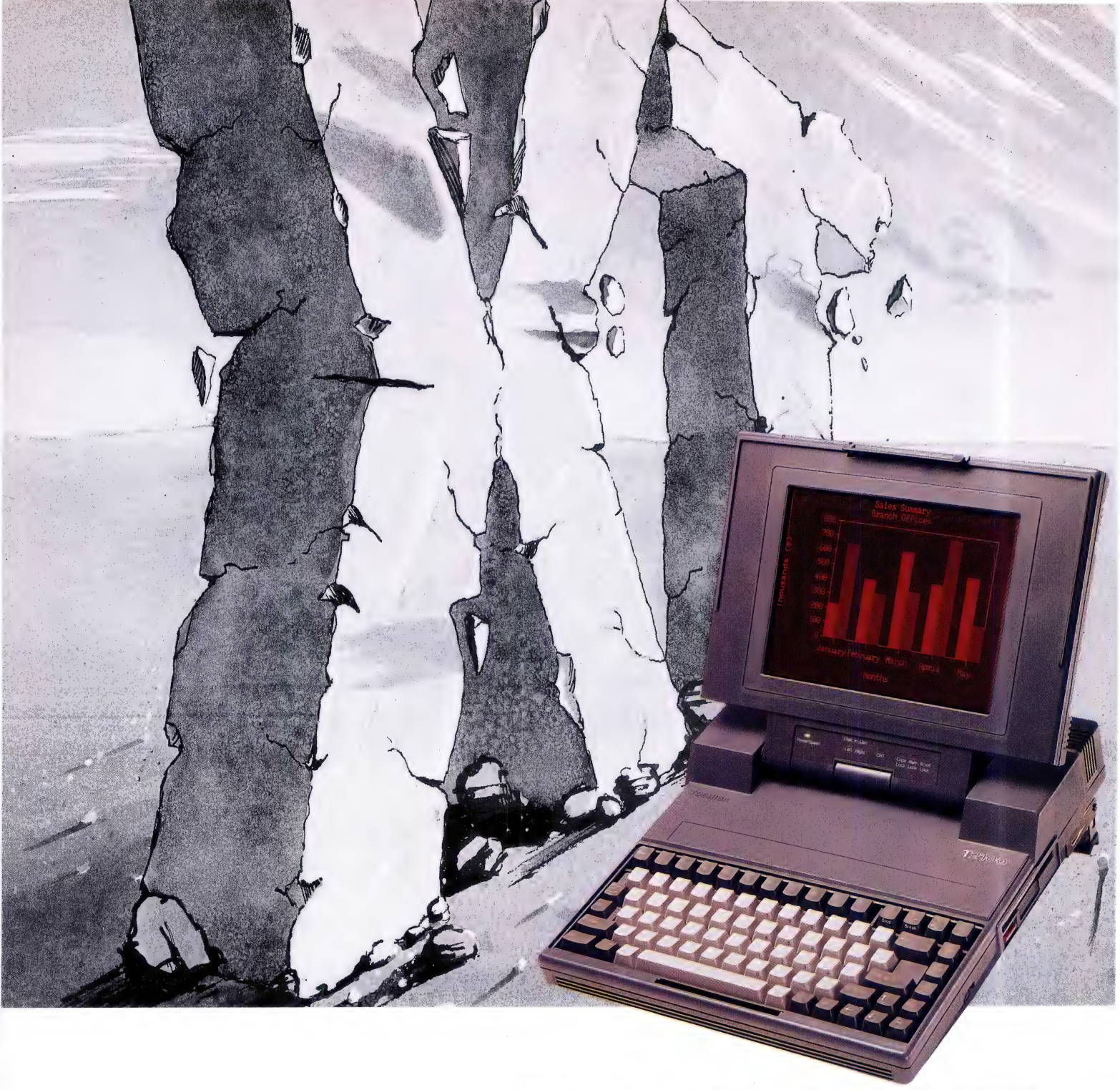

GIANT I

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They have greater versatility than either the XT or the AT (and, of course, they **are** compatible).

Both come complete with a superb plasma screen that sets new standards of clarity and definition for desk top computers.

The Toshiba T3100 features internal hard disk storage and an in-built 720KB disk drive. The T2100 offers the choice of either internal hard disk

NILLERS

with a disk drive or dual internal drives. And all of this comes at a price that makes all other business computers as over-priced as they are over-sized.

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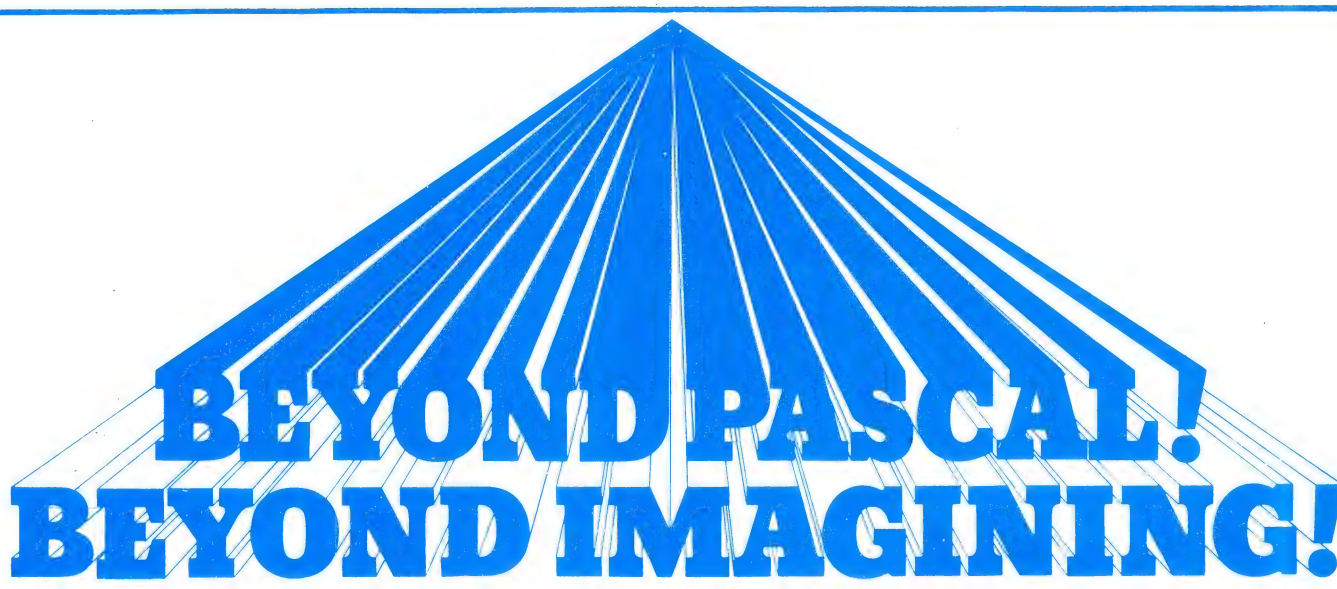

Now the same powerful tools Micropro used to develop its latest word processing system is available to you.
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Now you can create your professional software development system using the proven technical sophistication of Logitech Modula-2/86.

Modula-2 is a simple, but powerful, general purpose systems programming language designed by Niklaus Wirth, the creator of Pascal. Ideal for professional software development, Modula-2 corrects Pascal's shortcomings, incorporates major improvements and offers true modular programming. The unique module structure eliminates the need for non-standard extensions and makes Modula-2 programs easy to read, write and maintain. Within hours, programmers familiar with Pascal can be using Modula-2.

LOGITECH's Modula-2/86 Base Language System is a complete development system for programming 8086/8088-based microcomputers in the Modula-2 language. The development system and the generated programs can run in the MS-DOS (PC-DOS) or CP/M-86 (Concurrent CP/M and MP/M-86 environments). It also generates software for standalone, OS-less or ROM-based systems.

The Modula-2/86 system consists of a compiler, linker, symbolic debugger, module library, and user manual. The compiler translates full, standard Modula-2 source to efficient native machine code. A VAX/VMS version of Modula-2 is also available.

LOGITECH

Base Language System $160
- Compiler & Linker
- Module Library

Base Language System/8087 $233
- Inline 8087 code

Base Language System/512K $340
- Full 8087 support
- Uses RAM to increase speed by 40 to 50 percent
- 80186 and 80286 support

Run-Time Debugger $125
- Monitors the execution of a program with user-defined breakpoints or by stepping through the program
- Symbolicaly displays the source code, data, procedure call chain, and raw memory

Modula-2 Editor $107
- Fast on-line Modula-2 syntax check
- Can run compiler and linker from the editor
- Userdefinable templates for Modula-2 syntax constructs

Utilities Package $89
- Decoders: Disassemble link and load files
- Version: Administrate different versions of one program
- Post-Mortem Debugger: Debugs a program after abnormal termination
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acceptability in the marketplace and its leadership as a proprietary software product in the past year,' has caused this award to be presented to Consoft Ltd.

Wicked, wasn't I?

I rang ICP. Actually, I didn't have to. ICP rang Mr Aliss, who quoted my phone number. I revealed that it wasn't Mr Aliss's phone number at all, and that I was far from happy about these mysterious phone calls he kept getting. I revealed that I was a freelance journalist.

'What steps,' I asked, 'do you take to ensure that the correct information reaches you?'

In the case of genuine software companies, they get the formsigned by an accountant — either the company's auditors, or the financial director.

In our case, the quoted official is one LD 'Lazy Dog' Spencer. (Why Geoff Reiss calls his mongrel Spencer I don't know, but he does). I have a delightful note from Consoft here, in which Mr Aliss, the managing director, speaks very highly of LD Spencer's contribution to the company.

'Mr Spencer,' he says, 'has been with us most of his working life, but of course has not been working at all during that time.' And he gives details of Mr Spencer's security operation: 'This involves running a micro-biotic, small-particle factory examination of all visitors,' which, it is later explained, 'consists of sticking his nose into the visitor's crotch.'

I suggested that the precautions taken were not, of themselves, sufficient to avoid double-dealing. I didn't mention LD Spencer.

ICP claimed that it had, several years ago, had the same thought. It had chased after all the people who had submitted claims to have sold more than a million dollars' worth of software, and investigated them.

'And we found that they were telling the truth,' said an ICP executive.

These awards shouldn't be

'Good God, Miss Hargreaves — it's a blackmail note!'

mocked too much, just because some plausible conman managed to get through the system. In general, I think the system works.

When IBM claims to have sold over $250 million worth of mainframe operating software in a year, I believe that its accountants have checked the figures and found them accurate. And the plaque (somewhere in IBM) which notes that IBM is a member of the $250 Million Dollar Club is probably a source of pride to the software division controller.

Furthermore, when the Awards were first dreamed up by Larry Welke, president, there was a genuine reason for them.

At the time, the mainframe industry agreed, generally, that software was pretty useless and should be given away.

Welke it was who collected a list of people who had actually made a good living — even more than a million dollars' worth of sales — out of software, and held the first Awards ceremony to prove his point.

But I'm afraid that I don't believe that an ICP plaque on the office wall proves anything at all about the quality of software a company tries to sell you.

I have to admit, as a postscript, that D.B.X.V. is, in many ways, a uniquely bug-free program, and certainly deserves its Award. And there can be no more up-to-the-minute design . . .

Guy Kewney

Pick-Unix row settled

Readers of this month's article 'Take Your Pick' may be interested to learn that a $US6 million lawsuit brought by Pick Systems against VMark Computers has been settled. VMark sells Universe, a product which allows Unix users to run Pick-based applications.

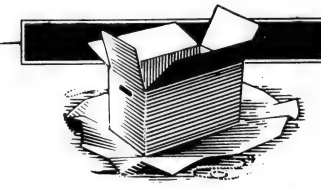
Under the terms of the settlement, VMark will become a licensee of Pick Systems.

No doubt this news will be gladly greeted by AT&T which had chosen Universe as part of a drive to attract additional users to its Unix operating system by being able to also offer a range of applications written under Pick.

Bludner

Last month's Benchtest of the Bondwell 8 lap-top failed to mention who distributes the machine. It is Amus Computer Corporation; tel: (03) 555 3644.

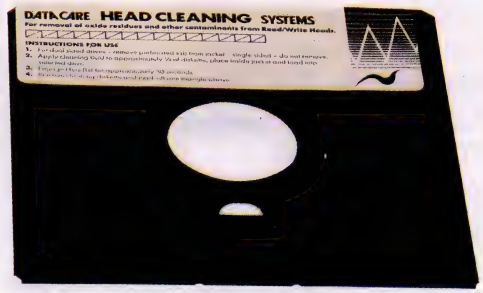
END



WHAT'S NEW

From this issue, Newsprint has been extended to include a product news service. See page 145 for this month's inaugral column.

CARING FOR EQUIPMENT



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NEC's new APC-IV provides complete compatibility with IBM's PC/AT but has a lot more inside.

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With a clock rate of 8MHz and no wait state architecture, the APC-IV runs rings around other computers.

The APC-IV is 40% faster than the IBM PC/AT.

Look closely at the screen — CAD users take note

You'll see either 640x350 pixels (EGA standard) or, with the optional Power Graphics Display, a staggering 1120x750 pixels. No other personal computer even comes close. The industry standard AUTOCAD software is currently being rewritten to take advantage of the APC-IV's resolution.

When you're looking for more storage . . .

The APC-IV comes standard with 40MB hard disk storage, upgradeable to 80MB.

And RAM to 10MB.

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Standard fittings include I/O facilities for parallel and two serial ports, clock/calendar with battery backup, 8 expansion slots and five internal peripheral slots.

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APC-IV has the ability to combine APC-IIIs and IVs, using the APC-IV as a file server with total storage of 80MB. NEC's Netware networks up to 16 personal computers via single twisted pair cable up to 1,000 feet in length.

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Nec's Powerful Apc IV

YANKEE DOODLES

Technology moves on to record-breaking speeds with the introduction of the world's fastest semiconductor — David Ahl sets this month's US news in motion.

Record-breaker

Scientists from AT&T Bell Laboratories and Cornell University have built the fastest semiconductor device ever demonstrated — a switch capable of turning on and off an electric signal in 5.8 picoseconds (5.8 trillionths of a second). The previous switching record for such devices was 8.5 picoseconds.

In the time it takes the new device to open or close, light — travelling at 186,282 miles per second — would travel only one-sixteenth of an inch (1.6mm). This speed rivals — and beats — a competing technology, the superconducting Josephson junction, which requires a supercooled environment of liquid helium (4.2 degrees Centrigrade) to operate. The new device achieved the 5.8 picosecond record at the temperature of liquid nitrogen (77 degrees K, or −196 degrees C). At room temperature (300 degrees K, or 27 degrees C), the switch operates at 10.2 picoseconds.

Circuit components in the new switch are as small as one-third of a micron. By combining submicron technology and exceptionally high-quality control of materials, the scientists have shown that features of that size can be integrated with larger elements to create ultra-high-speed circuits. Moreover, the submicron gate technology has very low power requirements, thus making it suitable for use in onboard satellite communications equipment, as well as computer microprocessors and memories.

Showdown

The semi-annual Consumer Electronics Show packed in the usual 100,000-plus people with acres of nifty new products, industry experts speculating on the future of car telephones and computers, glitzy parties, and scantily-clad-centrefold girls.

Most experts are in agreement that the bottom of the home computer market was reached six months to a year ago. Things look much rosier now, and major store chains have been placing large orders. Atari looks like the big winner in 1986, Apple having all but bowed out of the home market, and Commodore is said to be in deep financial trouble. The Japanese have permanently shelved their plans to introduce MSX in the States, Amstrad has positioned its system as an office word processor, and the only other players are Video Technology and Franklin (both with Apple II work-alikes).

Atari's show stand was the size of a small building lot, one-third of which was filled with 24 smaller stands exhibiting the products of various software vendors.

Make it Move for the ST allows the user to use a paint program to generate and display graphics and animation sequences. Created by Avila Associates, the package features video transitions, zooms and fades; price, $US49.95.

New from Activision was Paintworks, a comprehensive paint program and graphics editor which includes options such as cut-and-paste, free-hand drawing, multi-level magnification, custom lettering and the use of clip art; price, $US69.95.

Batteries Included was showing a comprehensive line of software for the ST including Degas (a graphics editor), an enhanced version of Paper Clip (a word processor), and the Isgur Portfolio System (an investment management package).

In the area of hardware, Hippopotamus was showing a sensational video digitiser for the ST. With resolution of 320×250 and up to 16 grey levels, the digitiser can be used to print black and white images which can also be edited with Neochrome or Degas.

Commodore played it low-key and didn't even have a stand on the floor. Instead, the company had a hotel suite where it handed out press kits with a glass of wine.

Let's hear it!

Having read glowing reports of voice recognition by 'gee-whiz' writers for years, many people became disillusioned and sceptical when the technology didn't live up to their expectations. Optimists became pessimists, and writers started to pan the technology.

Today, however, voice technology is blossoming. Those who said that it would never work are being proven wrong as innovative users find ways to make voice recognition both practical and profitable. Applications — for years limited to factory production lines and the machine shop floor — are finding their way into offices and laboratories.

For example, radiologists at New England Baptist Hospital dictate reports to a Kurzweil Voicesystem (KVS-PPC, $US6500) with a 1000-word vocabulary. The report appears on the screen of an IBM PC as it is being dictated; if a mistake is made, the radiologist is able to backtrack verbally and correct the error. Reports, which previously took days or weeks to be typed, are now done in a matter of minutes.

Robert Newman, a developer of interactive video systems, has put together a system called The Interactive Classroom ($US10,000 complete). It uses Introvoice boards with an Apple II, a VCR, a projection TV set and 30 transponder keypads made by Reactive Systems. In a school, the system might be used to show a short video segment on, say, geography, and then display a question with a menu of answers. The students use the keypads to answer the question; the teacher scans the answers on the Apple display, and uses voice commands to continue to the next segment, review the previous one, or display the student responses on the large screen.

Other voice systems are being used to sell insurance and recognise the responses of sales prospects, verify the identity of users of high-security computer systems, and analyse the speech patterns of whales, porpoises, and other animals.

Random bits

Since the third quarter of 1985, sales of IBM PCs have been slipping, while the sales of PC-compatible makers have been on the rise. Nevertheless, IBM still has nearly an 80 per cent market share followed by Compaq, Leading Edge, Epson, AT&T and NCR... Disappointing sales of AT&T's Unix PC have led the company to reposition the machine as a multi-user system rather than trying to continue to sell it as a powerful stand-alone desktop PC. Personally, I still don't see much of a market for it... IBM, too, isn't selling nearly as many PC Convertible laphelds as it anticipated, mainly because the machine is incompatible with many applications and Lotus 1-2-3 is not yet available for it... Apple has entered into a 'technical collaboration' with the National Geographic Society and Lucasfilm (Star Wars, and so on) to explore the effective use of CDs and video discs in education... Peter Norton has released the Norton Commander, a mouse/menu/window-driven hard disk organiser... Multibotics is finally shipping the Robotics Workshop, an interface between a Commodore 64 and motorised Capsela Construction Sets. The kit comes with six Capsela assemblies, infra-red sensors, a software disk, and an instruction manual with 50 experiments. Creating some controversy in the computer games field, Infocom has released Leather Goddess of Phobos, a humorous but 'naughty' spoof of a pulp science fiction novel of the 1930s. It has three levels of play: Tame, Suggestive and Lewd.

Quote of the month: 'Trying out software on typical computer users gets you back in touch with how complex it all is' — *William Gates, Chairman, Microsoft.* END

NEC APC IV

NEC specifically asked that Phil Cohen not do this review, after the caning he gave the APC III earlier this year. So naturally we couldn't resist asking Phil to do it. And here it is: Cohen on the APC IV.

When I reviewed this machine's predecessor, the APC III, earlier this year, I had some not very nice things to say about it. In fact, I had so many bad things to say about it that I suspected at the time that NEC was working on something along the lines of the APC IV.

The basic problem with the APC III was that NEC was trying to go it alone. The company started with a machine which was basically incompatible with the IBM PC, and then later tried to bring it back into the fold (and the market) by adding a card called the 'SLE' to allow it to run more PC software.

But the APC IV starts from where the APC III should have started from — compatibility. This time, it's too late for PC compatibility to be enough, and the APC IV is an AT compatible. Not a bad one, either.

Hardware

The APC IV is a large machine at 540 × 165 × 420mm. It will easily take up most of your desk, and you'll find out why all personal computer manuals come in small binders: so that you can fit them on what's left of your desk when the computer is on it.

The colour scheme of the machine is similar to the APC III — grey and cream — and it looks fairly impressive. There are four cut-outs on the front and the machine can handle up to two floppies, up to two hard disks, and an optional tape backup drive. The review machine was supplied with one 40Mb hard disk (yes, that's 40Mb!) and a 1.2Mb floppy drive.

On the front panel is the only thing that allows the initiated to tell a PC compatible from an AT compatible — a key-operated switch with the legend LOCK/UNLOCK/RESET on it. The idea is that when you want to protect what's on the disk, you turn the key to LOCK, and this makes the keyboard go completely dead.

This will of course only protect it from the merely curious, rather than from the downright nosey, because (unlike other similar machines) there's nothing to stop someone from 'hot wiring' the switch by first removing the machine's cover. But it's a very useful facility for all that.

The RESET position of the switch (and it was a good idea making it key accessible only) is the equivalent of the reset button on other machines, and of the CTRL-ALT-DEL key combination on the PC and AT. The difference is that the switch is a proper *hardware* reset, which will restart the machine and get you out of trouble even when the thing is so confused that it doesn't recognise a CTRL-ALT-DEL.

More like a re-arranged PC keyboard than AT-compatible

Next to the keyswitch is a pair of lights, which glow when the power is on, and when the disk is being accessed. Then come the four disk/tape cut-outs — that 40Mb hard disk takes up only as much room as a standard-height floppy drive. This makes me think that the 10Mb drive on my machine (which seemed to have an awesome capacity when I bought it nine months ago, and which is currently 95 per cent full) is not as big as I thought it was!

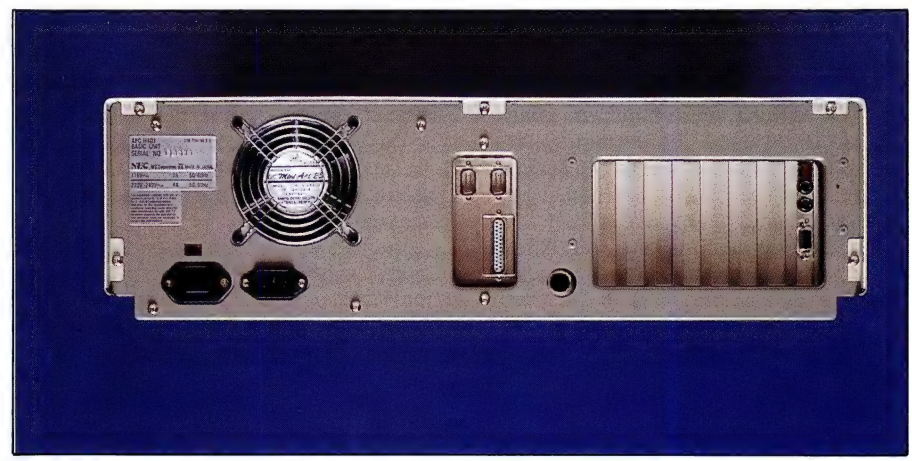
At the base of the front panel, tucked out of sight under a ledge, there's a little switch labelled '6/8'. This gives you the choice of running the 80286 processor at either 6MHz or 8MHz.

Naturally, 8MHz makes processing faster. The reason for giving you the choice at all is that some software will not work properly at 8MHz, so there has to be an easy way to change when you go from one piece of software to another.

I found out entirely by accident, by the way, that you have to reset the machine every time you change the position of the 6/8 switch. When you toggle it the machine hangs — which I suspect is something actually designed into the system. I certainly wouldn't want to think about what might happen to memory requests half way down the bus when the clock rate changed, and about how that might mangle the odd byte of data. I suspect that something in the hardware makes damn *sure* the computer 'hangs' when you toggle that switch!

Part of the start-up sequence involves the computer producing a trial 'beep' on its internal speaker, and the note produced during this beep changes according to the position of the switch — which is a nice touch.

The power switch is in the standard



"The usual confusing selection of sockets . . ."

IBM position, round the right-hand side of the case. That puts it far enough away to stop you hitting it with your coffee cup handle, but near enough so you don't have to be double-jointed to reach it without getting to your feet.

For an AT, the keyboard is a bit of a disappointment. It's basically a PC keyboard, with enough of the keys moved to make room for decent-sized Enter and Shift keys.

The keys which have been 'moved' are enough to annoy someone who (like me) habitually uses a PC-layout keyboard, but not for very long. The Esc key has been shifted from the top left of the qwerty area to the top left of the numeric pad, and replaced with the 'open single quote and squiggle' key (which is just to the right of the double quote key on a standard IBM keyboard).

In the place where the 'squiggle' key was, there's a useful extension of the Enter key which, just for a change, has the word 'Enter' on it as well as that awful 'down and left' symbol. As someone who writes a lot of software documentation, I appreciate that greatly — it means I can use the word 'Enter' to refer to that key without using a diagram.

The PrtSc key has gone into the numeric block too, to make way for a gigantic right-hand Shift key, and the left-hand Shift key has been extended into where the \ key used to be — it's gone up to the top right of the qwerty area.

For the first few times I looked for the Esc and \ keys, and found this way confusing. But after a while I decided I liked the layout more and more.

Because of the addition of the Esc and PrtSc keys to the numeric pad, the extra Enter key for numbers is gone: no great loss, especially on what must after all be a 'busy' keyboard, and with the 'real' Enter key just a few centimetres away.

The addition of a set of lights to actually show you when Shift Lock, Scroll Lock and Num Lock are on is also welcome. The only key on the keyboard which IBM PC users will find unfamiliar is the Sys Req key, which the manual says is to be used "by certain software programs to cause a specific action to occur". Sounds as if they had a blank spot on the keyboard layout?

On the whole, I liked the APC III keyboard (it was about the only thing I liked about that machine, in fact), and I like the APC IV keyboard even more.

The keys have a nice 'touch', and the usual pop-up feet make the whole thing quite comfortable to use. It's also light, and has a nice long lead on it for people who, like me, can't afford adjustable computer desks and like to use the keyboard on their laps.

Round the back of the unit there are the usual confusing selection of sockets. Why is it that one of the prerequisites for an IBM PC or AT-compatible is that most of the sockets must be unlabelled?

The mains input socket is next to a mains output socket — useful for the monitor, of course. There's a switch to select 110V or 240V, for those of you who run 110V sites in Australia. The monitor supplied with the review machine was 110V only and had its own external transformer, which is an indication of just how new this machine is in this country.

Next to the power sockets is a fan, which turned out to be an integral part of the power supply unit, as did the mains switch. (That is certainly a better approach than with the APC III, which had bare wires showing at the back of its power switch!)

In the middle of the cabinet are the sockets for two serial communications/printer ports (actually labelled, which is a nice surprise) and a parallel printer port, which are standard for all configurations of the APC IV and which are claimed to be totally AT compatible. There's a standard DIN socket for connection of the keyboard, and then cut-outs for each of the eight expansion slots.

On the review machine, one of the slots was taken up by a video card, and so had one IBM-standard RGB video output and two other phono sockets, at least one of which was presumably for composite video.

The card supplied with the review machine was IBM EGA (Enhanced Graphics Adaptor) compatible. NEC has another version which is compatible with the less powerful CGA, and a third — compatible with the top-of-the-line PGA — is due for launch here in October.

The monitor supplied with the review machine was an APC-H431 'Advanced Colour Monitor', which has a 350mm screen with a resolution of 800 by 400. Unusual for a monitor, there are actually a few controls to play with.

On the top of the monitor there is a little trapdoor, which opens to reveal controls for not only brightness and contrast, but also vertical hold, vertical size and vertical position, and horizontal position.

Also inside the trapdoor there are a couple of switches. The first changes the horizontal size by about 5 per cent, and the other switches from normal to a special TEXT mode.

TEXT mode simply makes the monitor monochrome. But unlike other monitors, it doesn't restrict your choice of colour to either white or green. There is a set of DIP switches round the back of the monitor that allow you to alter what colour of monochrome you get.

For example, if you want everything on the screen to appear in white on black, you switch to TEXT mode and turn the R, G and B (red, green and blue) switches on the DIP switch ON. Want green monochrome instead of white? Turn the R and B switches off. This arrangement effectively gives you a choice of seven colours of monochrome (all ON and all OFF are the same — white).

The advantage of TEXT mode is that for an analogue input (of which more in a minute), the TEXT white will be a whiter white than the non-TEXT white.

Round the back of the monitor there are even more switches. First, there's a power switch — it may be small point, but the monitor I've got connected to my machine has the power switch in the brightness control, which means that if you actually want to use it as a power switch, you've got to change the brightness level from what you found after long hours was a good compromise.

Monitors like that end up with little pencil marks showing where the 'best' level is. It is much better to have a separate power switch.

Also on the back of the monitor is a TTL/ANALOG switch, which allows you to use the monitor with both types of RGB input.

If a choice of colour or monochrome weren't enough, two more sections of that DIP switch allow you to choose eight, 16 or 64 colours, and you can select either the setting you choose on the DIP switch, or the normal setting for the monitor by switching yet another switch called MANUAL.

I counted 10 switches and six control knobs on this monitor — that's *got* to be a record. It even has three indicators to indicate whether you are in TEXT and MANUAL modes, and whether the power is on. And the indicators are on the top of the monitor, instead of being on the front, where they annoy the operator. My own cheap monitor has a piece of tape permanently in place across its indicator light, which is unthoughtfully placed right at eye level.

The only thing I could think of that this little beast didn't have was a composite video input. And the quality of the output? Excellent. It's nice and stable, too.

The monitor comes with a standard tilt and swivel stand, and all in all it's the best monitor I've seen in a long time.

Meanwhile, back at the APC IV itself... taking the top off is simply a matter of removing some screws at the back and lifting the cover. That's a much better arrangement than some machines (such as the IBM PC), where you have to

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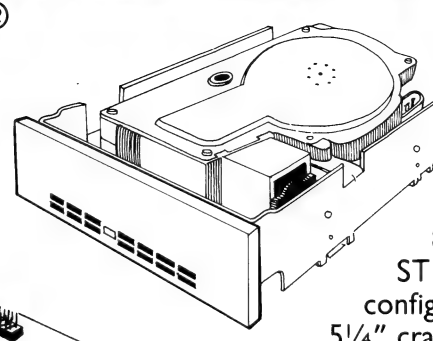

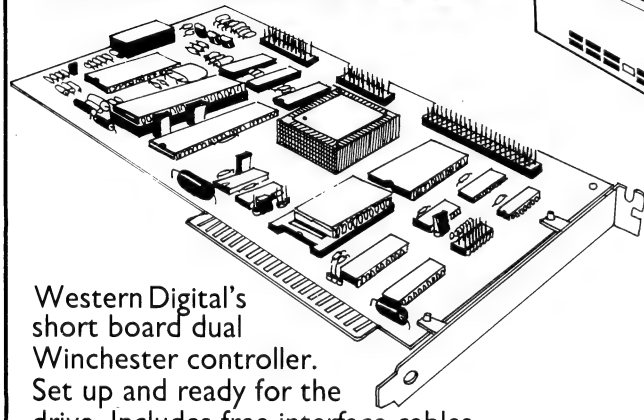

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slide a metal sleeve off the machine, but it's not as good as some PC clones, which have a sort of 'car bonnet' arrangement which sits up while you poke about in the machine.

Anyway, the inside of the APC IV looks good. There are eight slots (two short and six long), which NEC assures me are completely AT compatible.

In the review model, one of the slots was taken up with the EGA-compatible colour board (made by NEC), another looked like a memory board, and the third was the disk controller card.

The EGA colour board still had the odd wire link on it — a sure sign that this was one of the first few boards off the assembly line. (This is quite normal in review machines, and the wire links usually disappear by the time the machine hits the dealers). It had lots of DIP switches, wire links, extra board sockets and what looked like a plug-in ROM chip, all of which make me suspect that it's a very flexible box.

The 'memory' board was not fully populated (ie, there were sockets on the board which had no ICs in them). What surprised me most about the motherboard (which, by the way, IBM has taken to calling a 'planar board', to avoid charges of sexism!) was the fact that there was so little on it. The chip count looks very low for an AT.

There are six sockets that look like they hold the system ROMs — two of them were taken up with UVEPROMs (which may be replaced with ROMs in the final versions) from what looked like Phoenix. (When I turned the power on later, the sign-on confirmed this). Phoenix ROMs are more or less completely compatible with the IBM original (but of course are not copyright IBM). Even where they are not compatible, they are so widely used that any clever software developer will avoid the non-compatible areas, so that anything with a Phoenix ROM is a pretty safe bet.

Also on the motherboard of course was an 80286-8, the 8MHz version of the AT processor. There were also a few more DIP switches (generally a good sign), and an empty IC socket which was presumably for the 80287 maths co-processor.

A rechargeable battery pack for the internal clock — which is built into the motherboard, by the way — was held onto the back panel by a pad of velcro. I prefer something a bit more positive myself, but presumably it stays put most of the time. At least there are no bare contacts on the battery pack. The power supply is the now inevitable big grey sealed unit, complete with power switch and fan built-in, keeping all of the dangerous parts well away from the curious user.

There really are four spaces for disk drives in the box, and one floppy and one hard disk drive were fitted. The hard disk (which makes the strangest hard disk noise I've heard so far — not loud, or even annoying — but strange) is made by NEC, and holds a massive 40Mb. The floppy (also by NEC) holds 1.2Mb.

NEC tells me that the APC IV can handle two of those 40Mb drives, giving a total of 80Mb: that would be respectable for a small mini.

Unfortunately, MS-DOS lets you down here. It will only support about 32Mb on any given device (I wonder when Microsoft will get round to fixing that — it must be especially galling for people working with optical storage, where several thousand Mb are on a single device!). On the review machine, about 32Mb of the hard disk was configured as drive C:, and a further 8Mb or so was partitioned off, and appeared as drive D:.

All in all, the inside of the APC IV is neat and well-engineered. A fair amount of thought has gone into it. It even looks like it might be quite simple (although I admit I didn't try it) to operate the machine with the front panel off. This might not seem like a tremendous advantage, but when you're trouble-shooting a faulty disk drive, believe me it is. The bottom line for a user is that when your machine goes down, it will take less time to fix.

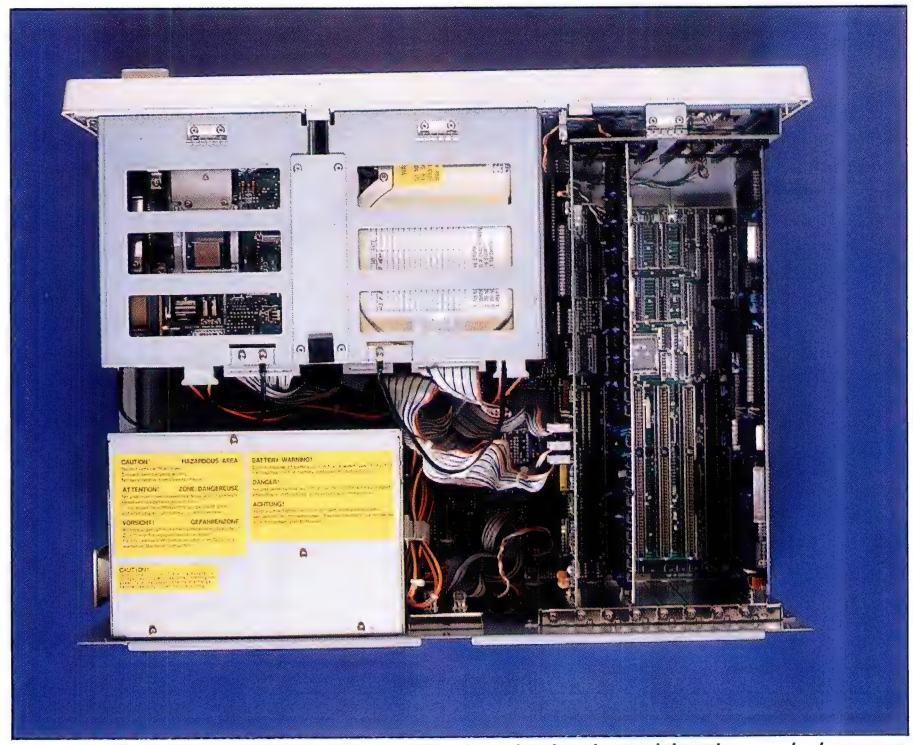
System software

When I powered up the APC IV, I got the Phoenix 80286 ROM sign-on, followed by a quick message check that told me that there was 640k of memory installed, and 1024k of expansion memory. The documentation points out that this is not actually 'expansion' memory at all, but 'extension' memory.

The difference is a subtle and complex one, but suffice to say that, firstly, extension memory (what the APC IV has) is better than expansion memory (which is what the sign-on claims it has) and, secondly, I think the sign-on message should be changed to avoid even more confusion.

Anyway, the upshot of all this is that the APC IV can have up to 2Mb of RAM added to it, on top of the maximum 640k that can be supported by MS-DOS. The extra RAM can be used for things like virtual disks, and it can be accessed by Pick and Xenix. Products such as Symphony can also use it, as it conforms to the Intel standard for expanded/extended memory.

The machine came with MS-DOS 3.1 and version 3.1 of COMMAND. Because of the differences in ROM, the APC IV wouldn't run my version of BasicA for the benchmarks (many compatibles won't), but another version (copyright Matsushita, strangely enough) was supplied with the review machine, and I ran the benchmarks with that instead.



The vertical view into the main system box is dominated by the sealed power unit

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BE QUICK — BE VERY QUICK

As is traditional, the floppy was configured as drive A:, and most (32Mb) of the hard disk as drive C:. But because of the problem with MS-DOS I mentioned earlier, there was another 8Mb partition on the hard disk which came up as drive D: — which made me think at first that this was a 32Mb hard disk!

The CONFIG.SYS file on the review machine also set up a virtual disk called E: in the expansion memory, taking up 512k of it. The total tally was therefore: A: 1.2Mb floppy, B: another way of calling A:, C: 32Mb hard disk, D: 8Mb hard disk, E: 512k virtual disk — and still 640k of RAM to play with!

I played with the 1.2Mb floppy for a while, and found that while it would read 360k floppies from my PC quite happily, when I tried to format one of my disks to 1.2Mb it (not surprisingly) found a few bad sectors. The APC IV would also write to a floppy which had been formatted on my PC, and a CHKDSK run on the APC showed that it treated the disk as a 360k disk. But for some reason my machine wouldn't read files that had been written by the APC — even though the formatting had been done on the PC.

Apart from that little problem, the APC seemed to be able to run any software I tried it with, and the review machine was supplied with AutoCad (which not only ran, but ran nice and fast).

There are a number of minor software problems noted in the pre-release version of the documentation which came with the review machine. I assume that they will all be fixed before the machine is sold to the general public. In any case, the only really bad one was the lack of a sensible return to a BIOS INT 13H (return drive parameters), which is unlikely to cause any major problems.

There is also a small problem with the VDISK virtual disk utility supplied with the APC IV, when the virtual disk is set up in extended memory. Essentially, it will cause the machine to ignore interrupts while the virtual disk is being accessed. To get around this, there is a parameter which limits the number of 'sectors' that are transferred to or from the virtual disk at any one time. The idea is that if it transfers only one at a time, say, it will be looking for interrupts at the end of each 'sector'. This will probably only be a problem with things like communications software, and the manual gives a couple of fixes that might work.

The DOS has the capability to give key-clicks, at a variable level of volume. When you boot the system the key-click is off, which is just as well, because if it had been on, the first thing I would have tried to do would have been to turn it off again!

In perspective

The APC III was released in 1984, and did very well in vertical markets, with large sales to the government in Australia in particular. However, the machine — although running MS-DOS — was not IBM compatible and secondhand prices for the APC III have been dropping over the past few months.

In November 1985, NEC released the 'SLE Card', which gave the APC III more or less 100 per cent compatibility, at a price. Market reaction (especially, I suspect, amongst people who had already bought one of the machines) to the SLE Card was, however, not good.

A spokesman for NEC said that the APC IV was a totally new machine, had nothing really to do with the APC III, and was aimed primarily at the corporate market. He added that the APC IV was not intended to replace the APC III, and that NEC would continue to support the APC III, which had sold well in vertical markets and in government areas.

As with the APC III, the DOS utilities supplied with the APC IV are a mixture of standard MS-DOS ones and variants written by NEC.

Of particular interest among the variants are:

- XASSIGN, which allows you to route all calls from one drive to another (which will be handy when your hard disk is configured as two drives!). XASSIGN also lets you redirect all calls for a particular file name to a different path and/or drive. This means that when you are using WordStar, you can have the overlay files on your hard disk *once,* and use WordStar from any subdirectory.
- CHMOD allows you to see and alter the attributes of any file. That means that you can set any file you like to read-only, or 'hidden' (which will stop it from appearing during a DIR) or 'system', which will stop you accessing it altogether. It also allows you to turn the 'archived' attribute on and off, which is useful for back-up. The MS-DOS utility closest to CHMOD is ATTRIB, which only allows you to make files read-only.
- COMP compares two files.
- CRTDUMP (could have chosen a better title — who calls them Cathode Ray Tubes these days?) allows you to dump the current screen contents (graphics and all) to an NEC printer. Colour screens can also be dumped to NEC colour printers!
- SIZE totals the number of bytes for any set of files — particularly useful if you want to know whether they are going to fit onto one floppy disk or not.
- XTREE does the same as the MS-DOS TREE, except that it only shows you what's in or under the current directory. XTREE also lets you delete a set of files, and you can get it to prompt you before deleting each one. This means that if you have a file with strange characters in the name (which has happened to me on more than one occasion) then you can delete it without deleting everything else at the same time.

The speed of operation of the APC IV can only be described as 'blinding'. The benchmarks over the page were done with the front panel switch at the 8MHz position — as a comparison, they are roughly twice as fast as the APC III. I repeated BM8 with the switch set to 6MHz, and got the expected 25 per cent reduction in speed, with a timing of 13 seconds.

Documentation

The only major criticism I have of the APC IV is the documentation, and it's something that could be easily fixed. Now, the documentation set I got with the review model was a pre-release version, and if NEC intends to fix this problem before it releases the first machines, well and good; but it had exactly the same problem with the APC III documentation and it didn't bother to fix *that*.

The problem is this: NEC has supplied a copy of the original MS-DOS manual,

Technical specifications

Processor:	80286, 8MHz (6MHz switchable)
RAM:	640k standard, expansion memory up to a further 2Mb
Keyboard:	IBM PC-style
Size:	540 × 165 × 420mm
I/O:	2 serial, 1 parallel ports standard
Expansion:	8 AT-compatible
DOS:	MS-DOS, modified by NEC

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with all of the utilities described as they were supplied by Microsoft. Then, in a separate section, they have told the reader what the difference is between the Microsoft and NEC versions. That means that if you are looking at the MS-DOS version of a command, there is nothing to show you that the version which is actually running on the machine may be different. The solution would be to interleave the MS-DOS and NEC commands, replacing the MS-DOS ones with the NEC ones where necessary. It doesn't look difficult to me, and it would make the manual a lot more readable.

Having said that, the documentation is not all that bad.

Prices

The APC IV is sold in three configurations. The entry-level one (called the APC IV-EL) has the unit itself, an Advanced Colour Monitor (same as the one on review), a 40Mb hard disk, a 1.2Mb floppy, 640k of RAM and a CGA-compatible video card, and has a recommended retail of $9935.

The APC IV-AG is the same as the base, but with an EGA-compatible video card, and it has an rrp of $10,448.

The third configuration, which will not be available until October, has a PGA-compatible card and a new monitor called the Power Graphics Monitor (with a resolution of 1120 by 750 and a 350mm screen), and that will have an rrp of $12,244.

An expansion RAM card with 512k fitted costs $593, and you can add up to three RAM chip sets to that for $296 each. A 360k floppy costs $450 and a second 40Mb hard disk is $2685.

Conclusion

The APC IV is what the APC III should have been — compatible, solid and fast. It's exactly the sort of machine that companies like Sperry, ITT and NCR have been producing. It doesn't try to go out on a limb (like the APC III did), but concentrates on being a workhorse which can run standard applications very quickly.

END

Benchmarks

BM1	0.5
BM2	1.5
BM3	3
BM4	3
BM5	3
BM6	6
BM7	9.5
BM8	9.5
Average	4.5

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BANKS' STATEMENT

Information gap

In their haste to get computerised, companies often fail to appreciate the pitfalls involved. Martin Banks provides an anecdotal warning.

Once upon a time I had the occasion to telephone an individual working in a large corporation, whom I wanted to ask about silly things such as management information systems.

Now, you all know what they are, don't you? They are the things which make working life an absolute breeze. Just look at all the adverts for any computer or applications package that is aimed at anything remotely 'business'. It will be roughly along the lines of 'Buy this XYZ and all your management problems will disappear.'

As if by some miracle, said XYZ will bring forth everything you ever thought you ever might need to know, regardless of whether you need it or are even in a real management position in a company, and make your life wonderful. Everything becomes so easy, and so damned *right*, that you will win lots of bonus points and be off down to the golf club with the managing director discussing that special directorship and saffron-coloured BMW you've always wanted.

So, I rang this man at the large corporation whom I had been told was a real whiz at management information systems. (He was, after all, a genuine user of such stuff and had been responsible for installing an extremely large one.)

'Go on,' says I, using my best interview technique, 'tell us all about it then — this management information system stuff.'

And he did, or more accurately he didn't. What he said was that he and his company had, like so many others, fallen into a most obvious trap; they had actually taken the advertisement at face value.

This meant that he had gone off and ordered a large and complex management information system, based around networked personal computers and large file servers, and stuff like that. Lots of fancy information management software was purchased and installed, and the redundancy notices for thousands of clerical workers were made out, ready for distribution.

Everything was therefore, going according to plan, or at least the outline of a plan as established by the advertisements. The systems were installed on managers' desks, the software was installed and run; everything was ready. Everybody worthy of the name 'manager' in the corporation got a machine and, by definition, access to all that lovely 'management information'. They all sat at their desks with fingers poised over RETURN keys waiting for the big *off*. Soon, they would be able to get any cut they wanted from all sorts of information about the corporation. As you can imagine, the excitement was intense.

The big moment came and the managers started hitting those keys. 'Given the average rise in car prices over the last three years,' keyed in one eager managing director, 'what growth rate is needed in our own gross margins to keep me in new Rolls Royces?' (It seemed a fair question, I suppose.)

Back came the answer, or to state things more correctly, back didn't come the answer.

It soon became clear what the problem was; the *nature* of the trap into which the large corporation had fallen. It had installed, as the adverts suggested, a management information system for the managers. What they had totally ignored, because no-one had stated it explicitly, was the other half of that double-barrelled name . . . information.

There was everyone doing extremely clever searches of a database in which there was no data, mainly because no-one had ever mentioned it should be there. Now — this might sound obvious, especially to anyone working in a company with a wealth of information already available, and in use — what this large corporation had ignored was the simple fact that implementing a computerised information system is like starting all over again, just like being a new-born babe.

The redundancy notices for the thousands of clerical staff were quietly put through the shredder. The smart new personal computer workstations were gently prised away from the clutches of the managers (well, you know how managers love their status symbols) and placed instead on the desks of the clerical staff. 'Generate', they were told in no uncertain terms, 'information.'

And so they did. Before any of the decision-making management could get their hands on the system designed specifically for them, they had to sit and wait for the company's clerical staff to load up all the information they were likely to need. All those invoices and purchase ledger details going back into the dim and distant past had to be provided — for example, not just entered but translated from an old presentation format into one decreed by the database management system.

As far as I know, and I admit that I haven't gone back to ask, the clerks are still there, keying in the relevant data for the managers. If they are lucky, some of the low-level managers (the information filters for the top-flight whizzos) will by now have got their hands on the occasional workstation. As for the managing director's high-priority personal enquiry, however, *that* will have to wait a while yet, I suspect.

This might have been an interesting story about a large corporation that 'got it wrong', had it not been for a recent survey carried out which showed that the more a company uses computers in its operations, the higher the proportion of clerical staff is likely to be. Such companies also demonstrated the wonderfully egalitarian ideal of having fewer managers as well, compared to equivalent companies that were not computerised. Not only that, but their decision-making processes were far less centralised, proving conclusively what we already know: the indians always know more about what's happening than the chiefs.

Lastly, these companies grew faster than the others, which just shows there is hope, despite what the advertisements state.

END


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Graphics to suit all palettes

Paolo Baccanello introduces part one of our look at graphics and presents a general picture of the products involved.

This issue we look at video adaptor cards and review the latest release from Hercules, its Graphics Card Plus. Next month, APC*'s graphics special continues with an overview of business graphics and CAD/CAM packages as well as a look at a range of video displays.*

The old adage that 'a picture paints a thousand words' takes on new meaning when applied to computer graphics. Substitute a graph or chart for a table, and figures can take on a thousand guises. Add colour or vary typestyle and you can dress up disastrous results or forbidding forecasts. Animate icons and pull down windows and you can make light work of complex operating systems.

With their obvious allure computer graphics have made a significant impact within the PC environment. Most applications whether business, technical or recreational now incorporate some kind of graphical element. Popular spreadsheet packages, like Lotus 1-2-3 and Javelin, allow you to display information in either bar, graph or pie chart form. The same applies to most integrated software as well as the odd database package (such as Borland's Reflex). Icons and windows are now *de rigeur* for DOS front-ends such as Digital Research's GEM. Advanced word processing packages can now cope with alternative fonts while the newly emerging desktop publishing software will accommodate illustrations alongside text.

Given the ever increasing amount of graphics-based software on the market, then, it is surprising to discover that a standard PC still has no inherent graphics capability. You have to add this at extra cost. The PC's open architecture and massive third-party support means you are quite literally spoilt for choice when it comes to putting together a graphics system. Adaptor cards, monitors and dedicated software abound, and for this reason it is a good idea to put the choice into perspective.

Products are aimed at two radically different kinds of user. On the one hand there is the businessman looking to enhance the reporting functions of existing software or improving the way information is displayed or presented onscreen. On the other is the designer or engineer for whom a graphics system represents a primary draughting or design tool.

For the businessman the most important consideration for choosing a graphics system is that it can easily integrate with existing applications. On the software side extensive and easy to use facilities to import information from other packages are a must. Good printer support which allows whatever is produced onscreen to be printed out on paper is also important.

Another consideration is that software complies with an established display standard (see adaptors) and that the standard be compatible with existing applications. This can result in considerable savings as non-graphical and graphical applications share the same adaptor and monitor. It is also a good idea to find out exactly what standard is supported. This may sound banal but it is surprising to see how many people invest in costly enhanced graphics adaptors and compatible monitors but are using graphics software that fails to take advantage of them.

When you look at the CAD field it is important to bear in mind that most of the software is designed for use on ATs. This is especially true of sophisticated 3D packages which make enormous demands on computing power, and even then are incapable of performing the real-time 3D parts rotations and sophisticated solid modelling of their prohibitively expensive minicomputer and mainframe rivals.

In any event the optimum configuration for most packages will be an AT or compatible with an 8 or 10 MHz clock rate. And an important consideration should be whether the software is capable of taking advantage of an 8087 or 80287 maths-co-processor and extended memory.

You should note, though, that an alternative to speeding up your PC is to have a dedicated processor chip on the video adaptor card. But such cards add a further obstacle to software compatibility and are usually geared to specialist packages.

The number and maximum resolution of the displays which CAD packages will support is also vital. You should look for EGA compatibility as a minimum prerequisite for professional CAD and support for at least two or three specialist high-resolution displays. In this respect Auto-CAD seems to win hands down, with support not only for IBM's EGA and Hercules graphics but also a vast number of specialist displays including the Verticom series, Control Systems' Artist board and Number Nine Revolution. Extensive support for advanced plotters and printers is also an important feature.

Software facilities in CAD packages vary depending on whether they are geared for specialist or general applications. However, all should at least include facilities to draw lines, points, circles, arcs, squares, rectangles and ellipses of various sizes. You should be able to fill in solid areas, vary line width, automatically close lines and combine entities with either straight or curved sections. END

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Adapting to the Video Age

In the first of our two-part feature on the PC graphics market, Paolo Baccanello puts video adaptor cards in perspective.

There are five display standards for PC video adaptor cards, four official and one *de facto*. They are, respectively, IBM Monochrome, IBM Colour Graphics, IBM Enhanced Graphics, IBM Professional Graphics and Hercules Monochrome Graphics.

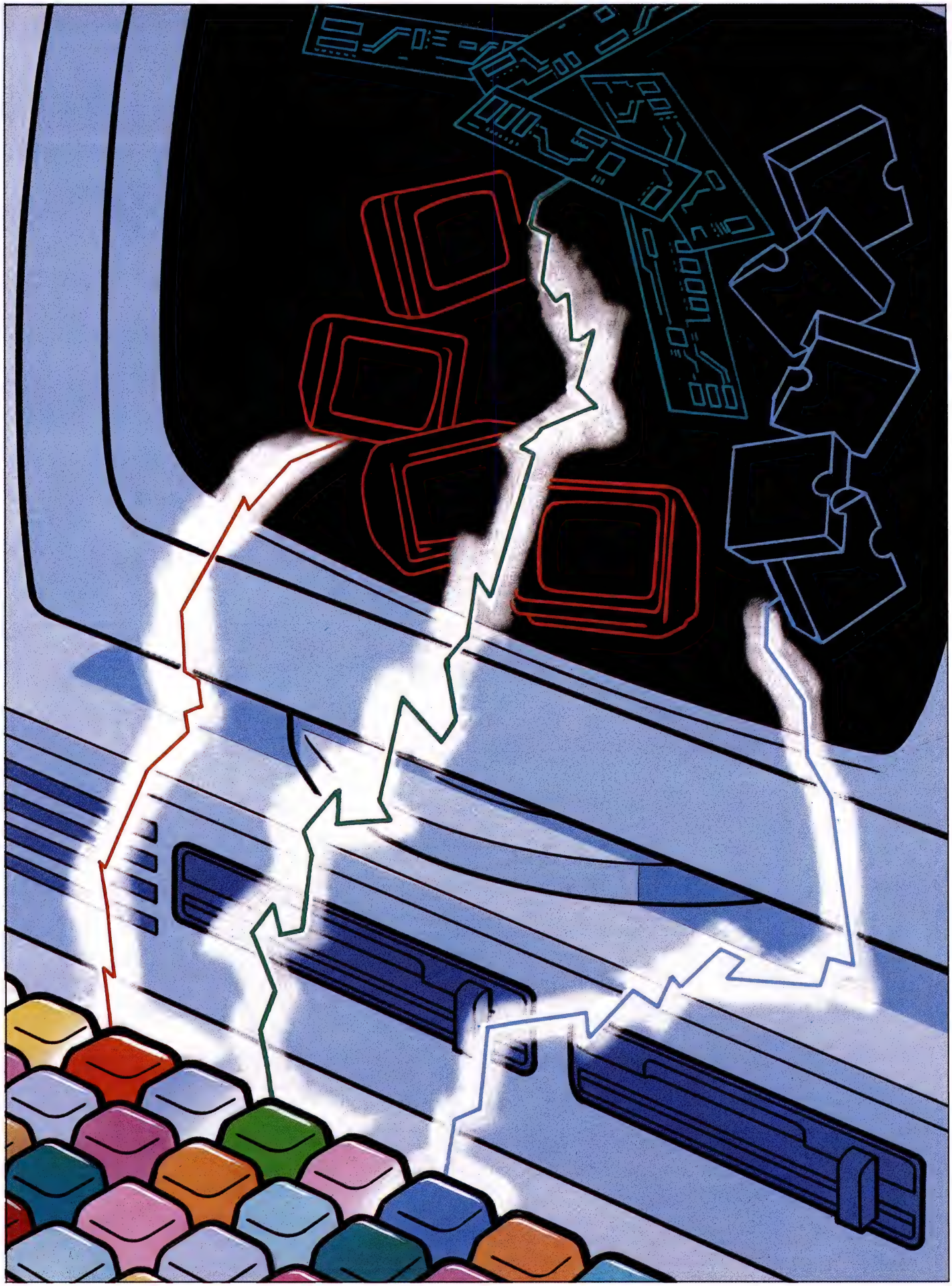
IBM's Monochrome Display Adaptor (MDA) comes as standard with most PCs and doubles up as a parallel printer interface. It is capable of displaying 80 characters of text over 25 lines. Each character is formed within a 7 × 9 matrix of dots with two extra dots to separate characters and five to separate lines. This gives an effective overall screen resolution of 720 × 350 pixels (or dots) which is more than adequate for non-graphical business applications that don't require pictures, graphs, charts or exotic symbols to be displayed onscreen. However, as PC software becomes increasingly more sophisticated, these 'standard' packages have become fewer and fewer.

IBM's Colour Graphics Adaptor (CGA) can display both text and graphics. The text display is of a considerably lower quality than the monochrome display with characters produced in a 5 × 7 dot matrix within an 8 × 8 background matrix. Graphics are produced either in four colours in a 320 × 200 pixel screen matrix or in two colours over a 640 × 200 pixel screen. This adaptor, with its reduced resolution yet added colour, can best be regarded as a stopgap solution never intended for professional use. This is exemplified by the fact that, on the original IBM card, the screen flickers irritatingly as it scrolls and cannot cope with underlining.

IBM's Enhanced Graphics Adaptor (EGA) could be described as the true graphics standard on the PC. It combines the various features of IBM's MDA and CGA adaptors into one and, at the same time, overcomes many of the difficulties associated with the latter. It also extends the PC's overall colour graphics capabilities by allowing text and pictures to be produced on a 640 × 350 screen matrix (or 8 × 14 text matrix) in 16 colours. However, at this resolution, the adaptor requires a dedicated monitor with a higher horizontal scan rate (22 KHz as opposed to 15.75 KHz). It should also be noted that the adaptor is capable of displaying two character sets of which either or both may be of your own making. This opens the PC to specialist linguistic language applications. There is also an option to add 256k screen memory which allows, for example, up to eight 320 × 200 16-colour graphics screens to reside in memory simultaneously. This means that graphics applications are greatly speeded up as you are able to hot-key from one screen to the next. IBM's Professional Graphics adaptor is a little known and rarely used high resolution adaptor which has now been pretty much eclipsed by the EGA.

The Hercules Monochrome Graphics adaptor is essentially an IBM MDA capable of displaying graphics as well as text on a 720 × 348 pixel display. Well-established and capable of generating high-resolution graphics on standard monochrome displays (which incidentally have inherently higher scan rates than their colour equivalents), the Hercules standard is an obvious choice if you aren't interested in colour. However, having said that, it is worth noting that the latest third-party EGA compatible cards are also Hercules compatible, and with prices dropping sharply these could create a single unified standard.

Finally, it's worth ending with a few words on non-standard cards for the PC. These cater essentially for the specialist CAD markets which developed with the introduction of the AT. Most require dedicated monitors with horizontal scan rates in excess of 25 KHz and will not work with standard PC software as they always need to have their own dedicated software drivers.



VIDEO ADAPTOR CARDS FACTS AND FIGURES

Name	Supplier	Phone	Price	Type	Board Size	Max Resolution	Colours or Shades
AST-3G	Imagineering	(02) 662 4499	1105	Enhanced graphics	Full	640x350	16 from palette of 64
AST-3G+	Imagineering	(02) 662 4499	1303	Mono & enhanced graphics	Full	640x350, 720x348	16 from palette of 64
AST Colourgraph Plus	Imagineering	(02) 662 4499	334	Colour graphics	Full	640x200	2 in hi-res 16 in low-res
AST Preview	Imagineering	(02) 662 4499	538	Mono graphics	Full	720x348	2 shades
Control System Artist 1+	Worldwide Business Systems	(03) 787 8221	3925 (ex tax)	Specialist CAD board	Full	1024x1024	16 colours from 4096
Control System Artist 10	Worldwide Business Systems	(03) 787 8221	5095 (ex tax)	Specialist CAD board	Full	1280x1024	256 colours from 256,000
Grafx Pro	Computer Enhancements	(03) 267 7829	506	Mono, graphics & high density text	Full	640x200, 720x348	4 in hi-res, 16 in low-res 2 shades in HMDA
Grafx-Pro+	Computer Enhancements	(03) 267 7829	557	Enhanced graphics	Full	640x350	16 from 64
HEGA	Computer Enhancements	(03) 267 7829	805	Enhanced graphics	Full	640x350, 720x348	16 from 64
Hercules Colour Card	Arcom Pacific Tech Pacific	(07) 52 9522 (03) 690 9055	369	Colour graphics	Short	640x200, 320x400	2 in hi-res 4 in low-res
Hercules Monochrome Graphics Adaptor (HMGA)	Arcom Pacific Tech Pacific	(07) 52 9522 (03) 690 9055	559	Monochrome graphics	Full	720x348	2 shades
Hercules Plus	Arcom Pacific Tech Pacific	(07) 52 9522 (03) 690 9055	675	Enhanced mono graphics	Full	720x344	n/a
Hypervid	Hypertech	(02) 819 7222	1450	Enhanced graphics & multifunction	Full	640x350	16 from palette of 64
IBM Colour Graphics Adaptor (CGA)	IBM	(02) 923 5123	376	Colour graphics	Full	640x200	4 in low-res
IBM Enhanced Graphics Adaptor (EGA)	IBM	(02) 923 5123	977	Enhanced graphics adaptor	Full	640x350	16 from a palette of 64
IBM Monochrome Display Adaptor (MDA)	IBM	(02) 923 5123	381	Monochrome text	Full	n/a	n/a
Kerry Card	Atlantis International	(03) 277 3139	299	Colour graphics & mono	Short	640x200	2 in hi-res 4 in low-res
Magic Card	EME	(03) 699 3088	330	Colour graphics & mono	Full	640x200, 640x350	2 in hi-res 4 in low-res
Matrox PG-1280	Mace	(02) 858 5800	4957	CAD board	Double	1280x1024	256 colours from 4096
Matrox PG-640	Mace	(02) 858 5800	4010	CAD board	Double	640x1024	256 colours from 4096
Mitac CGA	Computhink	(03) 584 3188	250	Colour graphics	Full	640x200	2 in hi-res 4 in low-res
Mita MDA	Computhink	(03) 584 3188	350	Mono graphics	Full	720x348	2 shades
Orchid EGA	Porchester	(03) 537 2722	1865	Enhanced graphics & 80286	Full	640x350	16 from palette of 64
Paradise Autoswitch EGA	SCA	(03) 699 7255	895	Enhanced colour graphics	Short	640x350	16 from palette of 64
Paradise Modular graphics card	SCA	(03) 699 7255	879	Mono graphics	Full	640x350	2 shades
Persyst BoB	IPL Datron Tech Pacific	(02) 698 8211 (03) 690 9055	952	Colour graphics board	Full	640x200	2 in hi-res 4 in low-res
Persyst BoB 16	IPL Datron Tech Pacific	(02) 698 8211 (03) 690 9055	1759	Enhanced graphics	Full	800x400 (text), 640x400	16 in hi-res out of palette of 256

Text	Compatibility	Software Install	Dip Switch Install	Standard	Comments
40, 80	EGA	No	No	Printer port	EGA clone
40, 80	EGA, CGA, HMDA	Yes	No	Printer port	EGA clone with HMDA & CGA modes
40, 80	CGA, Plantronics	No	No	Printer port	CGA clone with added colour
40, 80	HMDA	No	No	Printer port	Bundled with Microsoft Flight Simulator
Free form	None	Yes	No		For use with AutoCAD software, painting systems, Tektronix graphics emulations and NEC 7220 control graphics devices
Free form	None	Yes	No		Enhanced version of Artist 1+. Runs all major CAD software
40, 80, 2x25, 132x44	CGA, MDA, HMDA, Plantronics	No	No		Four in one
40, 80	CGA, MDA, EGA	No	No	Light pen interface, printer port, 256k	Three in one
40, 80	CGA, MDA, EGA, HMDA	No	No	Printer port	Software drivers not required
40, 80	CGA	No	No	Printer port	Will work in conjunction with Hercules Graphics Card
40, 80	MDA	No	No	Printer port, software utilities	A 'de facto' standard for monochrome graphics supported on most popular software packages
80-90	HMDA	Drivers for Lotus, Symphony, Word, Framework	No		Specially designed for software generated fonts
40, 80	EGA	No	No	256k Video RAM, 512k RAM, printer port, serial port, clock calendar, software	Cost effective Australian made with multifunction capability
40, 80		No	No		Poor performer
40, 80	MDA, CGA, EGA	No	Yes	2 user definable character sets	Sets the standard but faces stiff competition
80		No	No	Printer port	Comes as standard
40, 80	CGA, MDA	No	No	Utilities	Drives TTL or RGB monitors
40, 80	CGA, MDA	Drivers for Lotus & BasicA	Yes		CGA and MDA clone in one, with some mono graphics ability
40, 80	CGA, IBM PGC	Yes	No	VDI driver	Professional graphics for AT
40, 80	IBM PCG	Yes	No	VDI driver	Professional graphics for PC, XT or AT
40, 80	CGA	No	No		IBM CGA clone
40, 80	HMDA	No	No	Printer port, optional serial	Hercules HMDA clone
40, 80	EGA, CGA, MDA, HMDA	No	Yes (jumpers)	256k RAM, 7·2MHz 80286	Bundles 80286 to address EGA speed problem. Also bundled, Microsoft Windows
40, 80	MDA, HMDA, CGA, EGA	No	No		Automatically senses required video mode and switches to it
40, 80	CGA	No	No		CGA compatible driving mono screen. More CGA compatible than HMDA
40, 80	CGA	No	No		IBM CGA clone
40, 80	None	Drivers for Lotus, Symphony and AutoCAD	No	Printer port, light pen interface	Supports 16 and 8 bit technology and so is suitable for use on either AT or PC/XT

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TAXAN KX1212	$335.00	×	✓	×	20 Mhz	18.432 Khz	−10°C to +40°C	6.8 kg	×	×	205 mm x 150 mm
ROLAND MA-122	$262.50	×	✓	✓	20 Mhz	18.432 Khz	0°C to +40°C	7.0 kg	×	×	195 mm x 146 mm
QUBIE HR39	$320.00	✓	✓	×	20 Mhz	18.432 Khz	−10°C to +50°C	9.8 kg	×	×	204 mm x 135 mm

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VIDEO ADAPTOR CARDS FACTS AND FIGURES CONT.

Name	Supplier	Phone	Price	Type	Board Size	Max Resolution	Colours or Shades
Persyst BoB MG	IPL Datron Tech Pacific	(02) 698 8211 (03) 690 9055	561	Monochrome/colour graphics	Full	640x400	4 shades or 2 colours in hi-res, 4 colour low-res
Persyst Colour Combo	IPL Datron Tech Pacific	(02) 698 8211 (03) 690 9055	901	Colour graphics board	Full	640x200	2 in hi-res 4 in low-res
Persyst Colour Combo AT Version	IPL Datron Tech Pacific	(02) 698 8211 (03) 690 9055	1223	Colour graphics board	Full	640x200	4 in hi-res 2 in low-res
Persyst Mini Mono	IPL Datron Tech Pacific	(02) 698 8211 (03) 690 9055	398	Mono	Short	n/a	n/a
Persyst Mono Combo	IPL Datron Tech Pacific	(02) 698 8211 (03) 690 9055	901	Mono	Full	n/a	n/a
Persyst Mono Combo AT	IPL Datron Tech Pacific	(02) 698 8211 (03) 690 9055	1223	Mono	Full	n/a	n/a
Quad EGA+	Sourceware	(02) 411 5711	1269	Enhanced graphics	Full	640x350 (col), 720x348 (mono)	16 from 64
Sigma EGA	Computhink	(03) 584 3188	1100	Enhanced graphics card	Short	640x350 (col), 720x348 (mono)	16 from palette of 64
Sigma 400	Computhink	(03) 584 3188	1400	Dedicated CAD adaptor	Full	640x400	16 colours in hi-res
Taxan Colour 400	Megavision	(02) 957 5797	1425 (ex tax)	Enhanced CGA	Full	640x400	16
Taxan KIF 3800SP	Megavision	(02) 957 5797	580 (ex tax)	Enhanced CGA	Short	640x400 (mono)	4 in low-res 2 in hi-res
Taxan KIF-545	Megavision	(02) 957 5797	475 (ex tax)	Colour graphics	Full	640x200	2 in hi-res 4 in low-res
Tecmar Graphics Master	Repute	(03) 62 6737	1295	Colour graphics	Full	640x400 (colour), 720x700 (mono)	16 colours
VEGA	Dimension Graphics	(02) 929 5855	1315	Enhanced graphics	Short	640x350, 720x348	16 from palette of 64
XEGA	Computer Enhancements	(03) 267 7829	675	Enhanced graphics	Short	640x350	16 from 64

Text	Compatibility	Software Install	Dip Switch Install	Standard	Comments
40, 80	CGA, MDA	No	No	Printer and light pen port	Precursor to BoB 16
40, 80	CGA	No	No	Printer, RS232 ports, clock calendar	Three in one card
40, 80	CGA	No	No	Printer and RS232 ports, clock calendar, 128k RAM	Specifically geared for IBM AT
80	MDA	No	No	Printer port	Half size MDA clone
40, 80	MDA	No	No	Printer and RS232 ports, clock calendar	Three in one card
80	MDA	No	No	Printer, RS232 ports, clock calendar, 128k RAM	Specifically geared for IBM AT
40, 80	MDA, CGA, EGA, HMDA	Yes	Yes	256k screen memory	Full function EGA with Hercules compatibility
	MDA, HMDA, CGA, EGA	Yes	Yes	256k display memory, PC paintbrush software	EGA clone with Hercules compatibility
	CGA	Yes	No	RS232 port, mouse support and Paintbrush 400 Software	Requires 24.75 KHz monitor. Is supported on Lotus, Symphony and AutoCAD
40, 80	CGA	Yes	No	Printer port, Microsoft Windows	Many software drivers available
40, 80	CGA, Persyst BoB	For advanced features	No	Printer port	Boosts resolution on standard software to 640x400
40, 80	CGA, MDA	No	Mode switch	Printer port	Two in one
40, 80	CGA, MDA, HMDA	Yes	Yes	128k screen memory, software utilities	Offers similar resolutions to EGA
40, 80	EGA, HMDA	Yes	Yes		Uses VLSI to achieve small size
40, 80	EGA	No	No		Drives colour or mono screens

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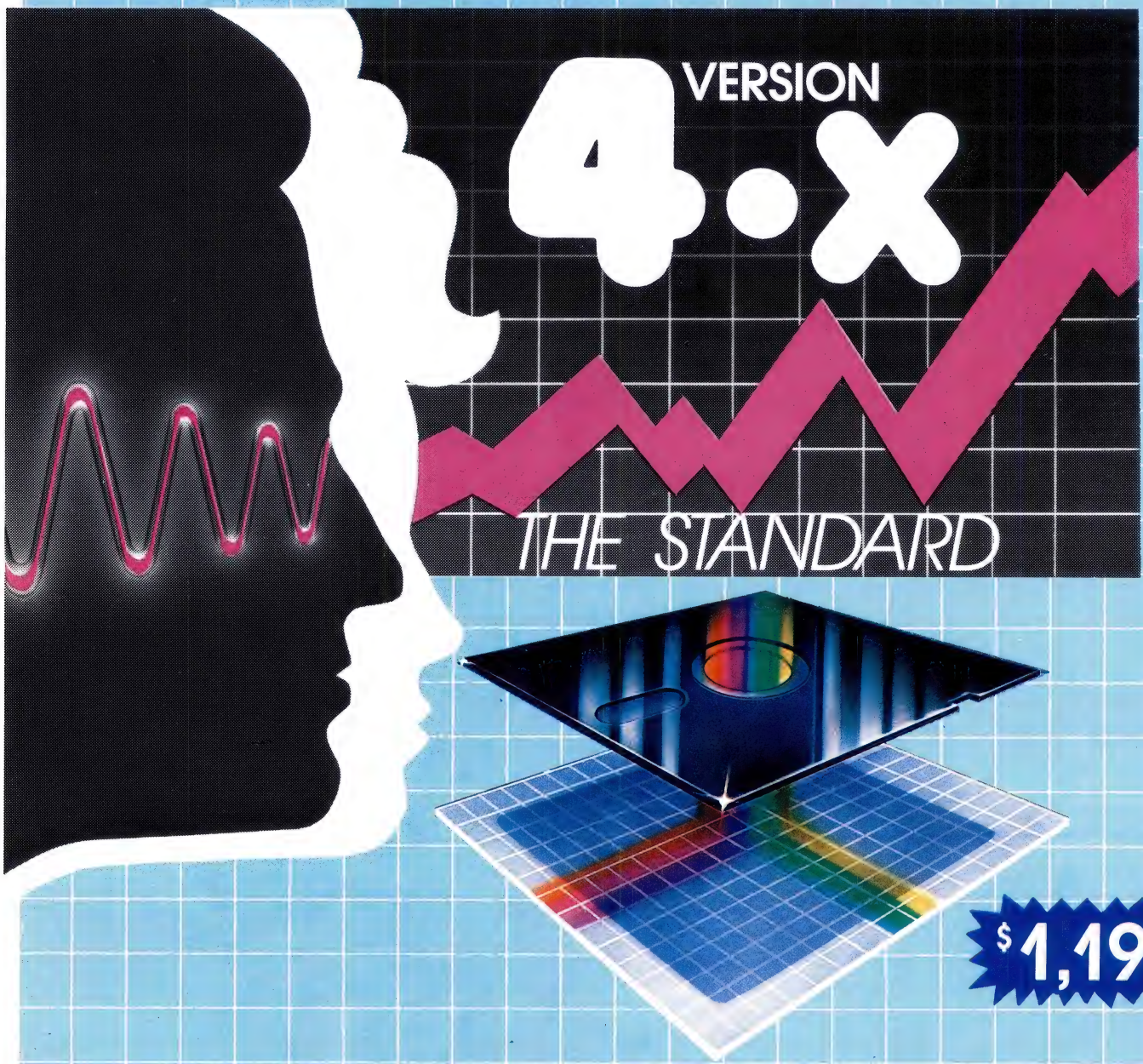

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Hercules Graphics Card Plus

With the release of their Enhanced Graphics Adaptor, IBM signalled to the world that high resolution graphics was no longer the preserve of third party manufacturers. The most successful of these — Hercules — has just returned to the battle. Ron Dunn takes a closer look at the new Graphics Card Plus.

In the days when the IBM PC was new on the earth — and doesn't it seem such a long time ago — there was the monochrome text screen, or the colour graphics screen. The monochrome screen gave you great text resolution but absolutely no graphics support, and the colour screen gave poor resolution and a limited range of colours.

A good reply to this situation was launched by Hercules in 1982. Its Graphics Card — a delightfully understated name — was one of the first on the market to combine the high resolution text of the monochrome adaptor with graphics capability *superior* to the colour graphics display. The card was technically well made and documented, and soon became a de-facto standard in the industry. While many other manufacturers offered alternatives to the Hercules product, none had quite the same effect on the market.

When IBM announced its Enhanced Graphics Adaptor (EGA) and Display in 1985, a clear signal was given to Hercules that quality monochrome support on the PC was no longer that company's alone. The EGA supported resolutions comparable to Hercules in both colour and monochrome, and provided developers with a new standard to work to. Supported by products such as Microsoft Windows, Freelance and many other software packages, the EGA offered IBM customers a chance to have the best of both worlds.

Developers of clone hardware chose an each-way bet — with most using the Chips & Technologies emulation products offering an EGA implementation with a level of Hercules support. For most monochrome applications this was good enough, but software really squeezing the Hercules product showed up the shortcomings of this method.

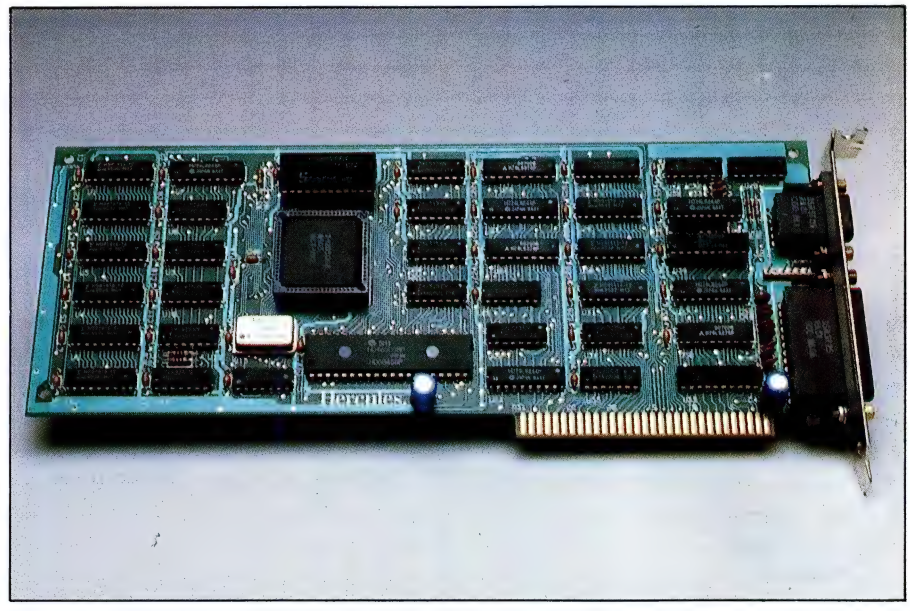
The stragegy employed by Hercules in response to this threat to its dominance is very clever — it has slashed by half the US price of its old card, and identified a market niche not supported by existing cards for a new development — the Hercules Graphics Card Plus.

In use

Installing the new card is very simple. Like most others now on the market, it consists of locating an empty expansion slot and plugging in the circuit card. No switches or jumpers must be set, although unlike the original card, Hercules now offers a feature to disable the parallel printer port. This is a little clumsy, involving the removal of an integrated circuit from a socket on the card — but is more than effective.

The card will still co-exist with colour cards for RGB monitor support if required.

The documentation supplied with all Hercules cards is thorough, and the Plus card is no exception. The manual gives a thorough treatment of programming the card's features for experts, but is a little beyond the scope of most card users. Ideally, most users would have absolutely no need for this information, but unless more software vendors move



to support the card, users may be reduced to writing their own software, just to get the most out of its capabilities.

Although only three-quarters the length of the old card, the new product is functionally equivalent (all the Hercules compatible software we tried ran as expected) and includes one new feature not present on the old Hercules card known as RamFont.

The Plus card now provides three operating modes. In text mode 256 extended ASCII characters are built into a character generator compatible with the IBM Monochrome Display standard. This mode is capable of displaying 25 lines of 80 columns, with up to seven display pages. Straight text display has traditionally been the fastest screen update method.

A graphics mode for the Hercules card provided the ability to manipulate individual screen dots — pixels — with the screen defined as 720 pixels across and 348 pixels down. This is a very flexible mode, as almost anything can be represented on the display. The drawback to graphics display is the processor time that must be devoted to updating individual pixels.

The new RamFont mode blends these two modes to provide extended text support, and allow text and graphics to be displayed on the one screen. This allows the developers of text oriented applications — such as quality word processors and the next generation of desktop publishing software — to store a variety of user defined fonts in memory on the card. These can then be displayed at the speed of standard text display.

Text sizes can be defined to provide from 80 by 21 characters per screen at the largest definition to 90 by 43 at the smallest. Character blocks can be combined to make even larger fonts on the screen. Up to 3,072 characters can be defined on the card, giving the equivalent of twelve standard character sets.

In addition to the standard monochrome attributes of underlining, high intensity, reverse video and blinking, an additional two attributes are provided: boldface and strikethrough. The application of these features in text oriented applications should be more than evident.

The benefits of these features are well demonstrated by the software supplied with the card. A driver for Microsoft Word is provided, as well as software support for Lotus 1-2-3 and Symphony. The Word demonstration is the most convincing where display speed is an issue — page scrolling is at least four times as fast as a standard card, with superior font resolution. The 1-2-3 demonstration offers spreadsheets with up to 30 lines of numbers, and sufficient columns to display a whole year's figures. As well, the Lotus drivers support the ability to mix fast graphics and text on the one display screen.

However, all is not rosy with the

Hercules: a success story

Hercules Computer Technology was founded in 1982 as a developer of display support products for the IBM Personal Computer. One of the original add-on product manufacturers, Hercules has enjoyed a reputation for technical quality, with some of the most copied cards in the industry.

Over 500,000 of the monochrome Graphics Card have been sold, with combined sales for it and the Hercules Color Card passing $US50 million in 1985.

The company was yet another backyard success story. Founded by the pooled resources of Kevin Jenkins and Van Suwannukul, initial sales were on a door to door basis.

Product development was provided by Suwannukul, with Jenkins providing sales and marketing support.

The company's name is derived from the town of Hercules in California, where business originally commenced. After one year of operation, business expansion forced a move to Berkeley, and the company has now a significant office and manufacturing plant in that city.

In 1984 Hercules doubled its one product line with the addition of a Color Card. This offered superior functionality to the IBM card, including a printer port, while occupying only a half length slot. Sales of this card proved significant for users of Portable PCs (RIP!), and power users of XT systems. A 1985 survey of magazine readers in the US saw the Hercules product voted as the most popular colour card on the market.

Hercules development is now aimed towards ensuring its monochrome graphics products remain a key force in the desktop computing market.

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drivers provided. For example, using Microsoft Word and the Hercules driver for speedy updates means giving up mouse support. This is a small price to pay if speed is the issue, and perhaps later versions of drivers for these products will not force this requirement.

Additional software is provided with the card for utility support. RamFont allows the card to be pre-loaded with fonts from diskette, and SetMode is a utility provided to manage screen mode switching. A substitute for the DOS Graphics command allows screen dumps to IBM dot matrix compatible printers.

The most interesting utility is that called Fontman. With this, and a sense of design, it is possible for a programmer to design and create unique fonts. This process is well documented in the manual, and in a little more than two hours, I was able to create the worst font I have ever seen — I am thinking of selling it to Microsoft for Windows under the name Times Scum.

Conclusion

The big question over the Hercules Graphics Card Plus is who will buy it?

Mixed text and graphics on the same screen, using the RamFont capability of the Graphics Card Plus

With EGA becoming more of a standard it would take a brave user to purchase a Hercules Plus card — unless the software market gets right behind the new product and offers superior packages to take advantage of its capabilities.

Although some argue that colour is not very important to business users, availability of software most certainly is. This may end up being the biggest drawback with the Hercules Plus. If the software manufacturers don't get behind it, and let's face it, IBM's EGA is quite a force in the industry at the moment, software availability may be limited to only those products for which Hercules can produce drivers.

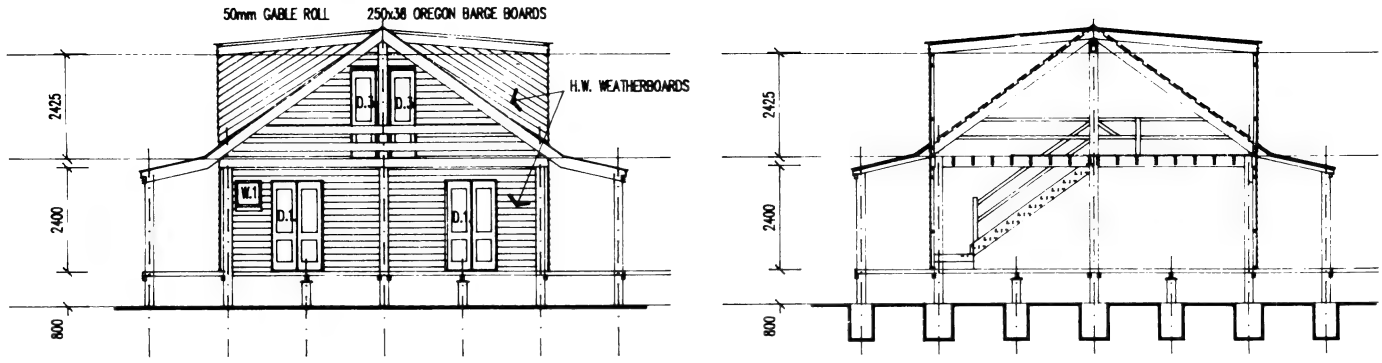
Certainly, where the software *does* support it, the Hercules card provides vastly superior display quality and update speed.

In addition, the provision of a Hercules monochrome system is still far less expensive than *any* colour solution. As companies watch the purse strings a little more tightly, this may become a major area for cost savings without affecting usability or quality.

The Hercules Graphics Card Plus is a major development — offering quality text and graphics support ideally suited to business processing. At a recommended retail price of $654, the effectiveness of this card is at least comparable to previous Hercules offerings, with the bonus of the new RamFont operation.

If the questionable software availability worries you, you could always take advantage of the card's introduction by buying one of the *old* Hercules cards, now available at very low prices. **END**

The Hercules Card Plus is distributed by both Arcom Pacific and Tech Pacific.



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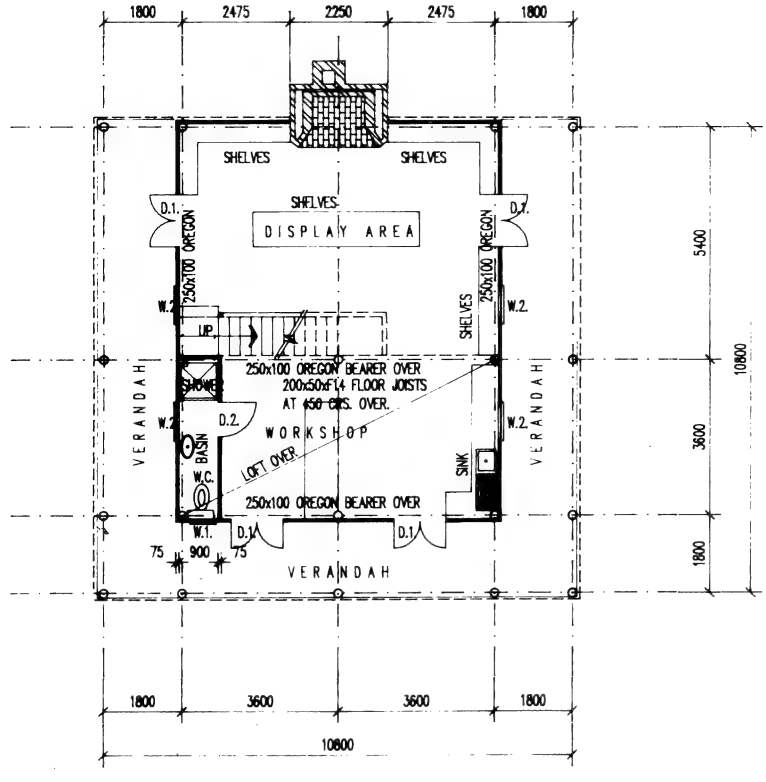

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Maths on the double

Samuel Dick opens the Pandora's Box of high-speed mathematics and discovers that everyone can benefit from a new species of computer chips.

Are computers really quicker than humans? Many people believe so — but is this belief justified? For many tasks the answer is actually 'no'. Think back to your childhood. Take an event at random and then remember as much about it as you can: the colours, the sounds, the ambience. How long did that take? Perhaps a few seconds.

That sort of memory recall and the ability of the brain to perform advanced functions, such as image processing, are taken for granted in everyday life. Of course, the brain is very selective about what information it does process so that the load is kept to a minimum but, for certain tasks, humans can make computers look really slow.

Mathematics is one area where machines are always thought to be much quicker — and more accurate — than their human counterparts. Although this is certainly true, machines are still rather slower than their reputation would have us believe. Even some 16-bit micros can take a few milliseconds to perform a multiply — not exactly instantaneous.

Who needs fast maths?

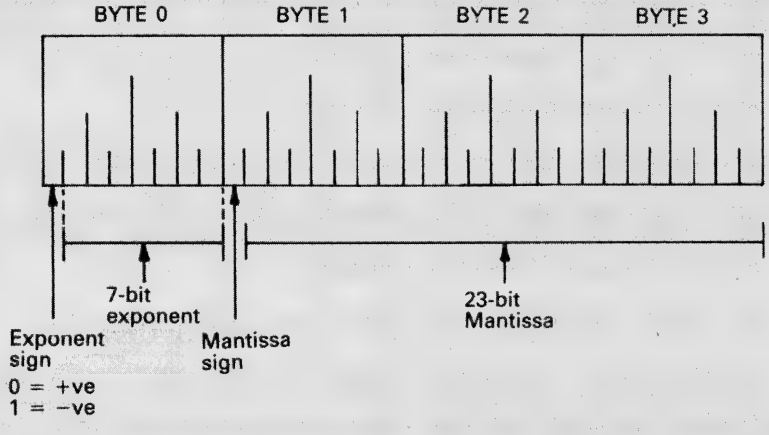
The ability of machines to perform numeric operations quickly is important in all fields. In office automation, the speech-controlled word processor or management workstation will depend on fast maths to perform speech recognition. Busy executives would then be able to speak to their word processor. And the workstation will be able to talk back, naturally. The ultimate convenience in the man/machine interface, perhaps?

One of the major inhibitions of people new to computers is the need to master the keyboard; hence the popularity of mouse-based systems. But detecting the spoken word by the different frequencies each word contains demands fast Fourier analysis of the speech after it has been digitised, and small machines are currently unable to cope with the workload satisfactorily.

In banking, electronic fund transfer demands encryption — this time, long integer words need to be logically shifted to provide the necessary protection against cryptanalysis. In telecommunications, analysis of signals decreases errors. For example, all-digital modems will perform the frequency detection needed to translate between audio tones and bits. They will include more comprehensive error coding to reduce the error rate associated with dial-up telephone lines.

Radar processing will make the airways safer — but a fast-maths machine would have to be compact to fit into an aeroplane. Processing of satellite imagery will help the Third World to manage the earth's resources. Satellite imagery in 1024×1024 arrays means a million operations for even the simplest of image processing functions; the handling of large arrays of data is also common in medical tomography. Tomograph scanners already help us to detect cancer and enable doctors to diagnose and treat many other disorders. Speeding all these tasks along requires real number-crunching power.

Nearly everyone could reap benefits



Byte 0: 7 bit-signed exponent gives $2^{\pm 127}$ or approximately $10^{\pm 38}$ when converted to decimal

Bytes 1-3: 24-bit signed mantissa. Each bit (going right) represents a decreasing power of 2

Note: floating point formats vary greatly from manufacturer to manufacturer

Fig 1 Representation of a floating point number

from machines which have an enhanced maths ability. And that is exactly what a new species of computer chip is achieving — sometimes cutting calculation time by a factor of 100 or more. But why are existing machines slow at maths?

Slow start

It's difficult to understand why computers are slow at maths until you look at the way in which they perform calculations. Part of the problem is that humans work to base-10 (decimal) while computers work to base-2 (binary). This means that each time a number is input or output in a human readable form, it has to be converted between ASCII and binary. However, the biggest consumer of time is the actual manipulation of the number, even when it is in its internal, binary format.

This format stores the number as a mantissa and exponent in base-2. Typically, a four-byte length is used where the exponent is held in one byte — giving a range of 2**(+/−128) — and the mantissa is held in the remaining three bytes with each bit representing a 2**(−n) component of the number; one bit is used for the sign of the mantissa. Fig 1 shows the format graphically. This refers to floating point numbers — integers, both signed and unsigned, are held in the more conventional form which duplicates how we would write a binary number.

Integers are very common in computing, but the majority of the applications that need fast maths tend to use floating point because its range allows real world figures to be manipulated — the real world never comes in integer form!

Looking at the simple algorithm for floating point multiplication shown in Fig 2 allows us to see why machines are slow at maths and also why processors with small words, such as the 8-bit word of most home micros, are much worse than, say, mainframes with their 32 or 64-bit words.

To take a few examples — look at the loop. Note that there is a 31-bit logical shift of the mantissa. A 32-bit processor uses one word to cope with this — an 8-bit processor would have to take each byte as an individual operation and check for 'carry' into the next byte. Even the 32-bit processor would have to do the addition loop many times — perhaps 63 times for a double precision number in Fortran (equivalent to about 16 digits of accuracy).

Similarly, addition, subtraction and division have their own algorithms. The use of trigonometric or logarithmic functions compounds the problems because they are calculated from long series, and each term in the series might need a multiplication and a division.

The author's home computer manages only about 200 SIN or COS calculations per second. An 8086 processor can take 20ms to perform a square root depending on number format and clock rate. So how is the problem of speeding-up machine maths to be solved?

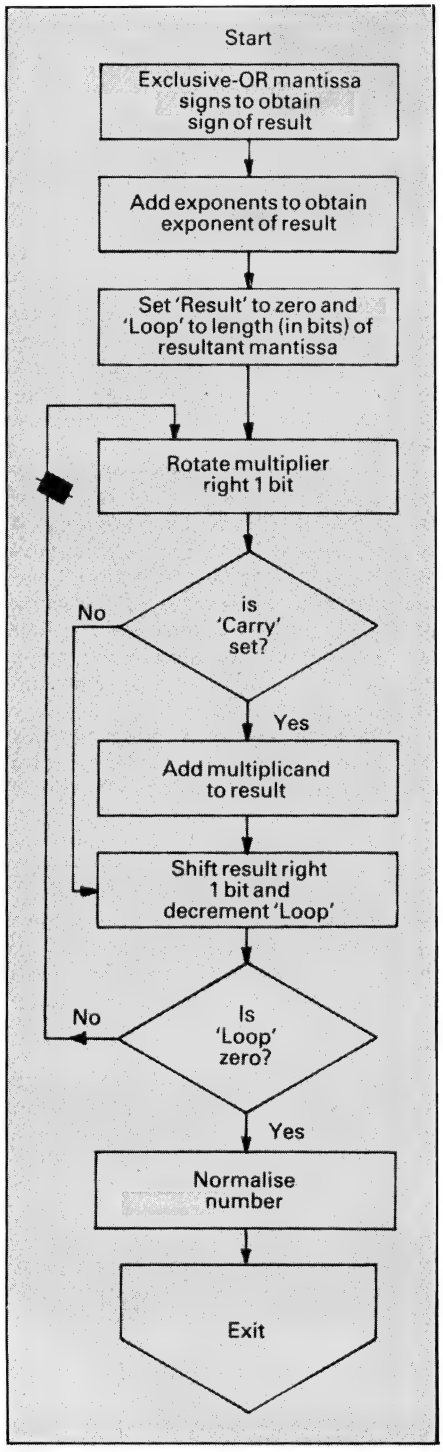


Fig 2 Multiplication algorithm for floating point numbers

Solutions

The slowness with numbers in the examples above is caused by the processor using its general purpose instruction set to handle bits and bytes under software control. If the whole operation could be done using dedicated hardware, then the speed might be improved.

And this is just what the major silicon houses have done. Gradually, each has introduced a floating point processor as an add-on to its range of processors. Mainframes and minis have had such devices for a long time; the 'industry standard' VAX II/series from Digital Equipment Corporation comes with a floating point acceleration which carries out most operations in around one microsecond.

Intel introduced the 8087 co-processor for its 8086 in the early 1980s. The use of the co-processor typically gives a factor of one hundred increase in speed. National Semiconductor has the NS16081 Floating Point unit for its 1600 series and Motorola is introducing the MC68881 Floating Point Co-processor which is mainly aimed at the 68020 32-bit processor, although it is designed to work with processors having 16 or 8-bit data paths.

The typical internal architecture of an FPU (floating point unit) is shown in Fig 4. Note how there are separate execution units within the processor for the mantissa and the exponent; a special shifter for the mantissa allows the adjusting of the antissa (before addition) to be done quickly. The internal registers of the FPU can hold all the data types handled: integers and reals of various lengths and packed BCD formats are held in registers which are 80 bits long in the 8087.

In operation, FPUs can be expected to perform the four simple math operations as well as logarithms, raising-to-a-power, and the calculation of trigonometric functions and their inverses.

Driving the chips

Integrating these mini-brains into a system is very easy — despite the complex task that they perform. When a compiler or interpreter comes across a math operation in a program — say, the SQRT (square root) function — it will place a call to a system routine in the resultant object code list. This system routine will, in simple systems, then calculate the required function using the standard instruction set of the processor. For example, the multiply function ('*')

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will be referred to a routine which obeys the algorithm shown earlier. However, if a floating point unit is present, the equivalent routine would just be the machine instructions to drive the unit.

This may mean that you have to buy a different language compiler depending on whether or not your system has the unit added. Some systems will sense the presence of the unit and translate math-operation calls by the compiler accordingly.

If you have a threaded interpretative language like Forth, then adding an FPU into your system may just involve the defining of a few new commands — one of the advantages of extensibility.

Each of the three devices mentioned above has its own way of interfacing with the rest of the system. The 8087 shares the system bus with its host processor — typically an 8086 or 8088. The 8087 watches the CPU's status lines and also decodes the instructions fetched by the CPU from memory. When an 8087 instruction is fetched, perhaps FMUL for multiplication, the CPU interprets it as an ESCAPE instruction. For operations that do not require a memory fetch, such as those that operate on the 8087's internal registers, the 8087 proceeds to perform the calculation. If a memory fetch is needed, the CPU obtains the word from memory but ignores it: the 8087 reads it in. If more than one word is needed by the 8087 to execute the instruction, then, once the first word has been read, the 8087 takes control of the bus and fetches the remainder of the words.

The 68881, by comparison, is never allowed to take control of the bus. All fetches and stores are performed by its host CPU. When the host has performed any memory operations for the 68881, the host is free to execute the next instructions. If the next instructions need the result of the task given to the 68881, then the host halts until the result is available, so a certain amount of concurrency is possible.

The NS16081 receives its order and data from its host CPU. Memory references involving the FPU cause it to read or write data from the data bus when the SLAVE-PROCESSOR-CONTROL line goes low; instructions are also sent over the data-bus to the FPU.

```
6800 CPU          ; address of most significant byte is in X
                  ; only 8-bit shifts available
                  LSR    3,X    ; shift msby right
                  CLC           ; clear carry bit
                  LSR    2,X    ; shift next byte
                  BBC LBL1      ; if no carry than goto lbl1
                  LDA A  80     ; carry was set so set msbi in 1sby
                  ADD A  3,X    ; add in msbit
                  STA A  3,X    ; store result away
          LBL1:   CLC           ; clear carry
                  LSR    1,X    ; shift next byte
                  BCC LBLO      ; if no carry then goto lbl0
                  LDA A  80     ; set msbi in accumulator
                  ADD A  2,X    ; set msbi in byte
                  STA A  2,X    ; store result away
          LBLO:   RTS           ; return
```

Total of 70 clock cycles

```
6803 CPU          ; same algorithm as above but with 16-bit shifts
                  LSR    3,X    ; shift least significant byte
                  CLC           ; clear carry bit
                  LDD    1,X    ; load 16-bit accumulator with top
                                ; two bytes
                  LSRD          ; shift them 1-bit right
                  STD    1,X    ; store them away
                  BCC EXIT      ; if no carry set then end
                  LDA A  80     ; set msbi in 8-bit accumulator
                  ADD A  3,X    ; add least significant byte into
                                ; this accumulator
                  STA A  3,X    ; store result away
          EXIT:   RTS           ; return
```

Total of 41 clock cycles

Fig 3 Algorithms to shift a 24-bit mantissa 1-bit right for processors with different abilities

If you think that floating point units are quick, you may be surprised to hear that they are actually beaten for speed by the latest members of the fast maths species.

Known as 'digital signal processing' chips, these devices are the state-of-the-art in speedy sums. While still not quite up to the speed of a mainframe or supermini, they do offer the designer of tomorrow's advanced systems a chip-level solution to computation problems. For example, the Texas Instruments TMS320 series boasts a sine or cosine calculation time of under 5ms; a 64-point Fast Fourier Transform (FFT) takes a little under 600 microseconds. Simpler chips designed to multiply are available from a number of sources including AMD, Analog Devices, and TRW. Some are capable of a 16-bit by 16-bit multiply in only 40 nanoseconds.

Current array processors, which can carry out many calculations in parallel, have speeds up to around 100 million floating operations per second — or 100Megaflops, in the jargon. Perhaps this is the way forward for the future fast maths chips?

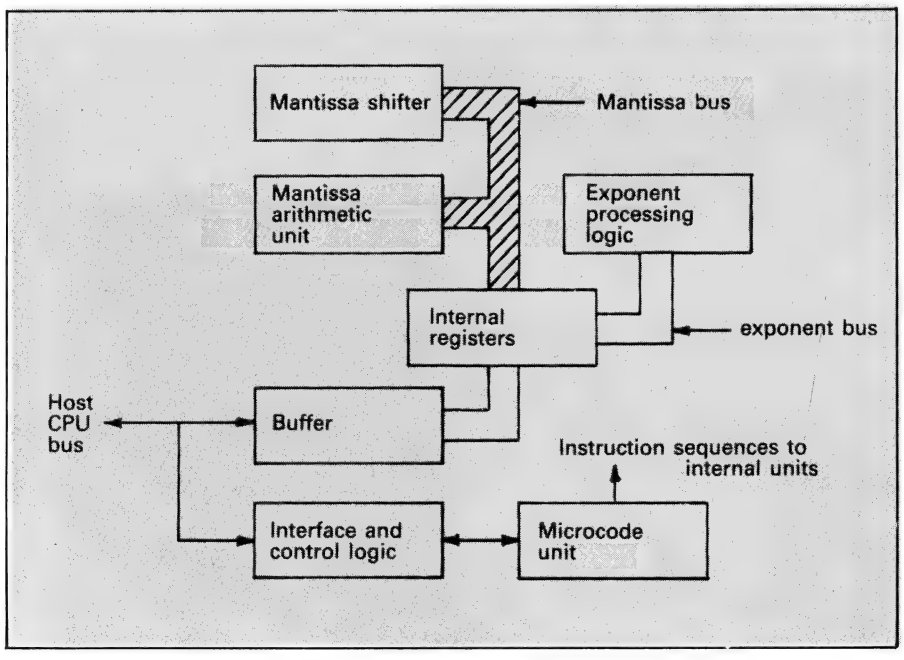

Fig 4 Typical FPU architecture

Conclusion

The future in fast maths may be closer than we think. After all, the Transputer from Inmos can form an array of computers to offer concurrent program execution — true concurrency, too, not just one processor multi-tasking. So how long will it be before we see arrays of Transputers on one silicon chip?

END

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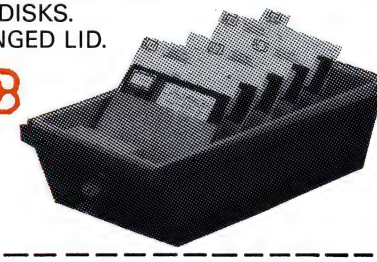

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Slow boat to China

China lags behind the West in terms of the micro revolution; surprisingly, the reason for this is not a lack of financial resources, but the Chinese language itself. But progress is being made in this direction, as Bob Couttie reports.

Out beyond the bamboo curtain a sleeping dragon is starting to twitch, and the shudders when it finally awakes could change the personal computer industry worldwide.

Buying power

To put things into perspective, mainland China's population is more than 80 times that of Australia: that takes massive administration. The Chinese authorities have committed themselves to modernising the nation's entire industrial base, introducing new management systems and improving education — all of which are natural markets for computers and computer software.

On the domestic front, the potential is enormous. In the West, few companies really take the Chinese consumer market seriously; after all, they haven't got much money, have they? Well, last year the Chinese bought so many Japanese TVs and 35mm cameras that the nation's foreign currency holdings were seriously damaged, and, as a consequence, the authorities had to clamp down on consumer imports.

Despite those clamp-downs, the Chinese population is becoming sufficiently consumer sophisticated for the authorities to want fast-food hamburger joints. If this trend continues, micros shouldn't be too far behind.

The worldwide micro market is dominated by the English-speaking nations for several reasons, not least of which is the fact that non-English based 'high-level' languages are non-existent, but also because the English speaking consumer market is the second largest in the world.

Yet in China there are a mere 1200 minis and mainframes and a tiny 125,000 personal computers — hardly enough to buy Jack Tramiel a cigar.

If the Chinese micro market takes off, it could not only make a few fortunes, it could change the whole balance of power in the computing industry. Not because the West will be flooded with 'Seagull' brand computers and 'Pearl River' software, but because even now Western software companies, such as Lotus, are running out of machines to write for and hardware manufacturers are running out of new markets.

So, what is to stop some bright entrepreneur buying up every PC in sight and floating them down the Yellow River? The same thing that has kept China out of several information revolutions down the millenia: the Chinese language itself.

A computer revolution requires two basic elements: an affordable machine; and a high-level language that provides access to its computing power. Even at the assembly code level, instructions are based on the Western alphabet.

> *'When it comes to software, the effect of the Chinese language and culture is likely to be even more subtle . . .'*

Chinese is probably the oldest language still in everyday use and dates from around 2000BC. The written form uses pictograms, picture-words in which, say, the word 'house' is represented by a picture of a house, with the addition of phonograms which define the *tone* in which the word is spoken. Every word needs a new character.

Written Chinese is so standardised that someone from, say, Lanchou in northern mainland China can write to someone in Singapore or Hong Kong even though they might not understand each other face to face.

Language problems

But the language has its drawbacks. There is no logical hierarchy in Chinese words, because there is no alphabet as such. Hence a Chinese telephone directory is ordered by the number of lines in the name of the subscriber. Currently there are about 150,000 Chinese words, and five new ones are added every day.

To add to the confusion, the Republic of China uses a simplified Chinese script while the Hong Kong Chinese prefer the traditional characters.

In languages with an alphabet such as English, French, Greek or Arabic, the tone in which a word is said has little effect, except perhaps for irony. In Chinese, however, a word like 'fu' can mean 'to return', 'to send', 'kingdom', 'father', 'woman' or 'skin', depending on how it is pronounced, and each meaning has a different character.

Although the Chinese invented movable type in about 1045, it was not until Gutenberg applied it to alphabetical languages in the 15th century that mass publication of books and information became possible.

That Western lead in information technology has remained ever since. Of the 125,000 or so PCs in China, only one in 10 is actually in use. The rest are stored in warehouses because, unless you can write and understand English, the machines just take up precious space.

Even typewriter technology has bypassed the Chinese language. The nearest equivalent is a miniature typesetting machine that takes six months' training to operate.

For the Chinese, this presents a formidable problem. If they can't communicate with the microchip, the computing world will pass them by — just as everything else has for the past 1000 years.

The problem is made worse by the fact that there is no accurate way of translating Chinese words into, say, the European or any other alphabet. Hence, when the Chinese authorities switched from the Wade-Giles system of

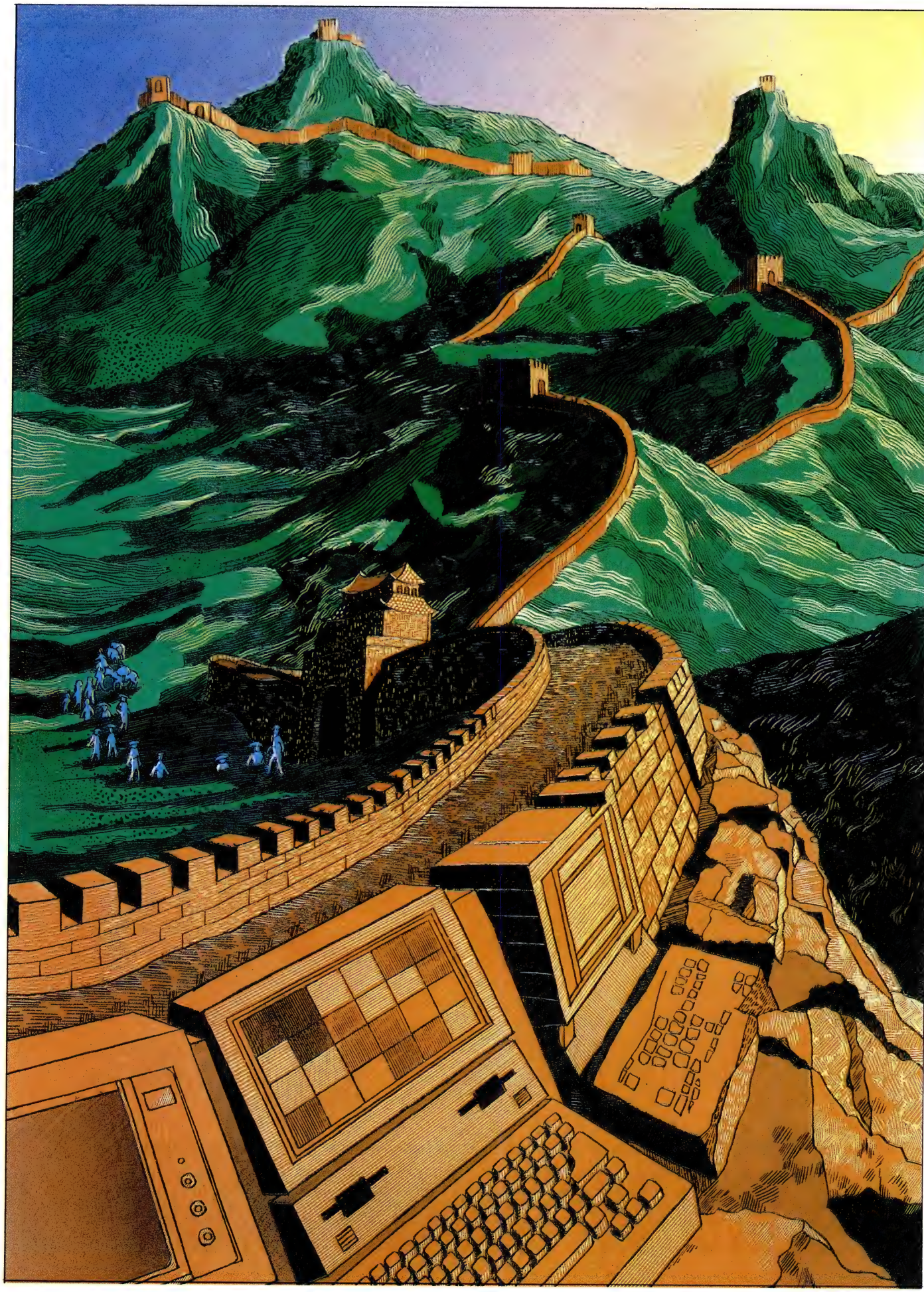

Illustration by Katharine Stephen

Compatible PC XT AT

Specifications:

Description	PC/XT	PC/AT
Processor Processor Speed	8088 4.77MHz or 6.77MHz	80286 6Mhz or 8MHz
RAM	640K	640K
Expansion Slots	8 (5 vacant)	8 (6 vacant)
Ports	2 × Serial 1 × Parallel	2 × Serial (1 installed) 1 × Parallel
Real Time Clock	Yes	Yes
Games Port	Yes	No
Co-Processor Opt.	Yes (8087)	Yes (80287)
Monochrome Hercules Comparible Adaptor	Std. 720 × 348 1 × Parallel	Std. 720 × 348 1 × Parallel port
System Pricing with: (Does not include Sales Tax)		
Single Floppy Two Floppies Hard Disk Drives	360K $1920.00 720K $2220.00 10MB $3295.00 20MB $3495.00	1.2MB $4595.00 2.4MB $5060.00 20MB $5995.00 40MB $7645.00
Video Options	Colour/Graphic Mono/Colour	320 × 200 4 colours 640 × 350 4 colours
Power Supply	150 Watt	200 Watt
DOS	3.1 Std.	3.1 Std.
Warranty	6 Months	6 Months
Availability	Ex-stock	Ex-stock

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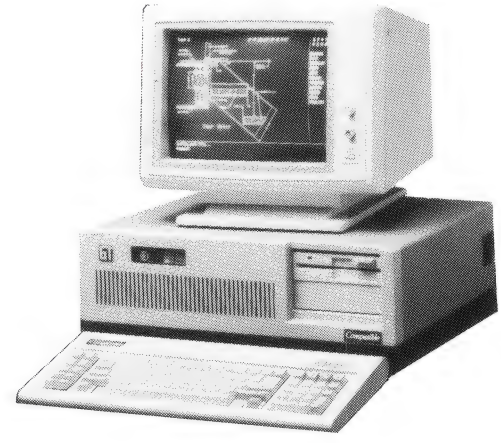

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representing Chinese words in European characters to the Pinyin system, 'Peking' became 'Beijing' and 'Canton' became 'Guangzhou'. And there are four different systems of translation in use — Pinyin, Wade-Giles, the Chinese National Phonetic Alphabet used in Taiwan, and the Yale system.

This leaves Chinese micro usage 20 years behind the West, in the hands of a few specialists within the huge Chinese organisations who can speak and write in English.

English is the *lingua franca* of international business communications for the Chinese, but it is limited to top managers and those with access to translation services. Concepts like the Computer Phone are pipe dreams. And while a number of PCs are used in business, the lack of a Chinese language front-end isolates the mass of the population.

One solution from a Hong Kong company is to take an IBM PC and adapt the keyboard to print Chinese characters stroke-by-stroke, with each key contributing one stroke. Although it is practical, training still takes around two months, too long for most managers and out of the question for the home user.

Chinese whispers

The future for Chinese data input is probably more along the lines of touch-screen technology, like the Intech CP2054B Chinese character processor, developed in the US for $280,000 and launched commercially in the Chinese market last year.

This uses an analogue resistive touch-screen which displays a main menu showing the initial symbols for Chinese sounds in phonetic form, typically using the English alphabet with one of the four translation systems. To get the character for 'an', the Chinese equivalent of 'peace', the user touches the letter 'a' on the screen and a second menu is displayed showing all the sounds beginning with 'a'. The user selects the 'an' sound and a third menu is displayed showing all the Chinese characters in memory with that basic sound, and the user touches the character having the meaning wanted. Although it sounds complicated, training is minimal. The CP2054B is merely a front-end for a 24-pin dot-matrix printer. Messages are built up on the screen and then sent to the printer. Anyone who can read and speak Chinese can use it.

Intech now has a Chinese personal computer on the drawing board and wants to market the touch-screen system to OEMs for incorporation in third-party hardware. Ashton-Tate is developing a Chinese language version of dBasell and Lotus is doing the same for 1-2-3. Some modified software was launched earlier this year. More important is the launch of software that will enable users to write software in a Chinese programming language.

With an easy-to-use (for the Chinese manager) front-end to word/character processing and database application, the door to the Chinese business market is beginning to tweak open a little.

The CP2054B is too expensive for domestic computers, at around $US5000 for a complete system with disk drives, but it should not be too long before competitors come up with similar devices which are somewhat cheaper.

For the Western computer user, there are likely to be new developments in touch-screen mouse technology and other forms of non-keyboard input such as graphics tablets, as manufacturers set up to hit the Chinese market.

Knowledge of Chinese is certain to become a marketable commodity among programmers as software companies gear up, too.

'If the Chinese micro market takes off... it could change the whole balance of power in the computing industry.'

Enough people own domestic TVs in China for the consumer market to be persuaded to buy a non-keyboard computer, perhaps with the keys replaced by a graphics tablet; such a package could be put together even today for less than $250. Smart-card mass storage should be cheap enough to replace tape cassettes and disk-drives. New systems of low-cost, non-disk, non-tape program and data storage are, almost literally, on the cards.

For software companies, a whole new market for expert systems will open up. China simply does not have enough doctors, teachers, veterinarians or agricultural specialists to cover the vast country side at the community level, so expert databases which can help identify problems and their solutions, or act as teaching aids, are in demand. Combine these with a hand-held unit and limited inputs through an adapted keyboard, and you'll have a saleable product on your hands.

Many of these products will find slots in the West, too, and will certainly affect the way we use personal computing power in business and in the home.

Something else will certainly happen. Only a few years ago in the West, the number of people with even a limited ability to program in machine code or high-level languages could be counted in their thousands; today, there are literally millions. Given the availability of a simple, high-level Chinese programming language, an enormous amount of computer talent could be unleashed.

How that would affect the West is impossible to say. But the concepts we use are dependent on the language we have to convey them and the culture in which we operate, and Chinese culture and language is so different that something new is bound to appear.

To take one example, the Chinese find it easier to use the abacus than the calculator, and with touch-screen or touch-sensitive tablets, or even mice, an onscreen electronic abacus is a practical proposition for numerical data input — indeed, Intech has included one on its own system.

Sun Tzu says...

When it comes to software, the effect of the Chinese language and culture is likely to be even more subtle, even at the level of computer games.

Take, for instance, the various forms of battle games. In the West these are largely based on force versus force, and acquiring enough force to overcome or obliterate the opponent. As in Clauswitz's *On War*, 'The general who fights and wins most battles is a good general.' The Chinese, however, use tactics and strategy based on the writings of Sun Tzu, the oldest and probably the greatest of writers on warfare, in which subtlety and speed are more important than raw force. 'To win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill,' he wrote. Indeed, the general who obliterates the enemy is a bad general.

This could impinge on serious software, too, particularly aids to decision-making — the principles of warfare transfer easily to business practice.

Slow boat to China

When China takes to computers, there will be fundamental and long-term spin-offs to the West, and it is a matter of *when*, not *if*. China's size and special needs make that a certainty. We, in the West, are in for some real surprises that no amount of star-gazing can foretell. For once, the future really is inscrutable.

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Microwriter

It's an innovative, portable, hand-held word processor. What are its chances against the qwerty keyboard? Kester Cranswick deliberates.

England has been the place where some of the oddest things have been invented — the game of soccer and the geiger counter to name but two. But it is also the home of one of the most radical computer products ever to grace these offices, in the shape of the Microwriter.

The Microwriter is not much to look at. It has six keys, a single line liquid crystal display and an RS232C port. Yet, with those minimal features, it is able to do just about anything a word processing PC can do. It brings new meaning to the term portable computing.

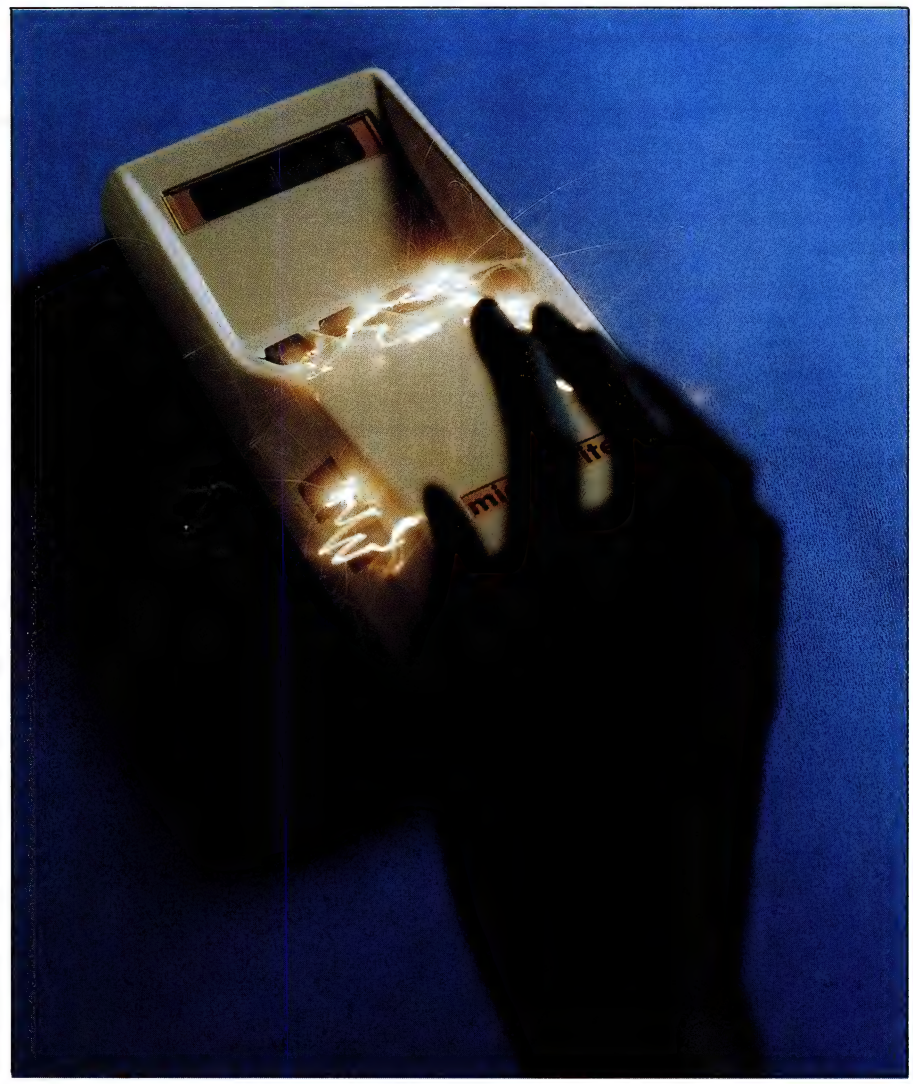
In 1973 an American conjuror, resident in London, was tinkering around trying to figure out how to get all the keys of the qwerty keyboard onto a handheld device for a word game he had made up. His name is Cy Endfield. His mind drifted to the concept of musical chords, and he hit on the idea of pressing a combination of keys to represent the letters of the alphabet.

'His mind drifted to the concept of musical chords, and he hit on the idea of pressing a combination of keys to represent the letters of the alphabet.'

A few hours later he and his wife had worked out what was to become the Microwriter. Now it is available in Australia, and those of us who aren't beyond trying something a little different have a new way to write.

The first thing to be said about the Microwriter is that it actually does work. The six keys do enable the user to perform word processing with a surprising turn of speed and using many of the features we have come to expect from such packages as Multimate, WordStar and Microsoft Word.

The Microwriter supports text editing, tabing, text formatting and printer control codes. It is powered by rechargeable batteries, can be connected to a monitor or a printer, can



communicate with other computers and can save text to tape.

With a size of 230mm × 117mm × 50mm and a weight of 735 grams, the Microwriter is eminently portable. It will fit in a coat pocket or briefcase and comes with a chocolate brown carry case. The built-in batteries have a life of 30 hours per charge, and recharge in 12 hours, using the supplied mains charger.

There are two versions, 8k and 16k, costing $695 and $995 respectively and storing roughly five or 10 A4 pages of text. An upgrade for the 8k model costs $300.

Inside, there is one PCB, and it is evident from the spacing of the chips that it is the size it is by design, rather than to fit everything in. An RCA 1802 CMOS processor drives the whole thing. CMOS RAM means that memory is non-volatile and survives intended or accidental power loss.

To save power, the Microwriter is programmed to turn off if the keyboard is not used for eight minutes, and return to the current cursor position when it is switched on. It can also be turned off from the keyboard, again with return to the cursor point.

The brown and beige casing has few features. The six keys dominate the front — more of those later. At the bottom there is a socket for the battery charging unit (you can run the Microwriter from the mains), and a 37 pin port, for diagnostic purposes.

At the top you'll find a standard 25 pin RS232C socket, an audio output socket and a diminutive on/off button. Four rubber feet on the base give stability on a smooth surface. That's all the Microwriter has.

Two instruction manuals, a suite of reminder cards, a cassette lead and the AC adaptor are supplied. The manuals are a model of simplicity, yet contain very detailed information about the more technical points of the device. An optional extra is a monitor interface box, costing $250. I'll come to that presently.

In use

The hardest thing about learning to use the Microwriter is starting to use it in the first place. If you are used to the qwerty keyboard, it takes a mental highjump to think that a six-keyed device can be as good. Those of you who have had minimal, as opposed to extensive, exposure to qwerty won't find this barrier so hard to overcome.

Learning to use the keys is surprisingly easy. I picked up the alphabet in an hour. In two days, I was quite happily typing away with only occasional references to the reminder cards. In two weeks, I knew all there was to know about the Microwriter.

The way the Microwriter is designed means that with the palm of the right hand resting on the base, the fingers and thumb are poised above five of the six keys. The letters of the alphabet are keyed in by pressing different combinations of these keys. The lower of the two thumb keys is a command key, and it is this sixth key that gives the Microwriter its versatility.

Input is displayed on a 16 character LCD screen. The two rightmost character positions are covered by a transparent yellow gel, and this area shows various settings that might be engaged, or gives warnings of low power, memory nearly full or full.

The actual display is 14 characters long, and, given the limitations of LCD, quite readable. Some of the lower case letters take a little getting used to, as descenders are not very clear.

'If you are used to the qwerty keyboard, it takes a mental highjump to think that a six-keyed device can be as good.'

The keys are sensitive, and until you are practised, it is easy to accidentally press keys by mistake. Mistakes aren't hard to correct, and the touchy keys enable an experienced user to write very rapidly.

Remembering the key combinations is not difficult. Endfield based his system on relating letter shapes and various memory aids to the keyboard. For instance, I is a straight line with thumb and index finger. Add a bar at the top, by pressing the ring finger key, and you get R. Add a lower bar to the I shape by pressing with the little finger and you key in L.

E is the most common letter of the alphabet, and is entered by pressing with the index finger. S needs the signet, or ring finger. O is like a bullseye so you use the middle finger. The first four keys give F. P is a full press of all the keys. X is everything except the index finger. So the list goes on, and in no time at all, most users master the alphabet shapes.

With just five keys then, all letters of the alphabet, a full stop, hyphen, comma and apostrophe can be entered. Upper case letters are entered by pressing the command key before keying the letter. Two presses of the command key give a caps lock mode.

Numbers and other punctuation marks (#, $, (,), *, +, −, X, /, =, ?, !, %, &, @ etc) are entered by keying in command N — an N but with the thumb on the command key rather than the thumb key — before pressing the keys. Two presses of this combination locks in the numeric mode. Upper case and numeric modes are indicated by the letters P and N in the yellow section of the display. Pressing the thumb and command key together cancels a mode.

As with any new process, the speed with which you become competent depends on how much practice you do. The inventor claims that, with experience, Microwriting is up to one and a half times faster than handwriting, and has the advantage that text is in electronic form.

With text keyed in, what can be done with it? The short answer is just about anything, and it all hinges around the RS232C port.

The easiest option is to make up a printer cable, and, with a single command, dump it to the printer. Or, through the audio socket, data can be saved to a cassette recorder, to be reloaded at a later time. Or, without too much trouble, text can be sent to another computer, perhaps for editing on its screen.

Another option is to use the accessory monitor interface. This is powered by the AC adaptor, and linked to the Microwriter by a cable to the RS232C port. An RF or monitor cable outputs data to a television or monitor.

The interface box is a featureless box 150 × 160 × 65mm in size. It gives white text on a black screen. On the Microwriter, command then command P toggles between screen and printer output.

On the screen 16 lines of text, 64 characters across, with formatting, are displayed. The cursor appears as a flashing line. For any substantial amount of text editing, given you can't get the text into a conventional word processor, the monitor interface is all but essential.

Which brings us nicely to how editing is done on the Microwriter. It is at this stage that a double-jointed thumb comes in handy, as all text editing and other commands are made using the command key instead of the thumb key. Getting the thumb used to jumping back and forth between its two keys, and at the same time remembering what command letter options do what, is the hardest part of learning Microwriter.

Microwriter documents consist of letters, sentences, lines, paragraphs and documents. Soft carriage returns are

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automatically inserted. A position marker can be inserted at any point and documents can be separated by user inserted document separators.

Text access commands allow the user to back or forward space either a character at a time, or continuously, with instant stop, and fast or slow rates. On the LCD screen, the cursor is positioned to the right of the 14th character. With short documents, this is a simple way to read, but longer documents take ages to scan through.

So, other text access commands move the cursor to the end of the next or previous line, the start of the next or previous paragraph, the next or previous document, the next or last document marker and the start or end of memory. To aid remembering the key commands, mnemonics are used. For instance, command J is jump back a line. Precede it with command P to jump back a paragraph. Precede it with command, and jump back to the previous document. There really aren't that many commands to remember.

Text is edited by overwriting or deleting memory contents. Deletion can be character by character, or continuously, word by word. This method needs care, as it is not difficult to go past the section you want deleted, and end up having to key in text again. Sections of text between document markers can be deleted too, or the whole memory contents. These commands give screen prompts to ensure you do in fact want to delete a document or documents.

Alternatively, there is an insert mode that can be toggled on and off by command I. In the insert mode, blocks of text can be loaded from cassette, so with

a little effort, a Microwriter user could produce form letters by writing blocks of text to tape, and then using the tape read and insert commands to put together combinations of pre-written text sections.

Using tape for text storage is simple enough. There are no file names, so it is best to verbally identify what is being stored on the tape. The Microwriter will load the first block of text it comes to.

The Microwriter has been designed with some useful aids to reading from tape. The display will show a dash or minus sign if the volume is too soft. A plus sign indicates a good playback level. When the text is loaded, the number of corrected errors is shown, and POOR TAPE appears if the recorded text cannot be loaded. The tape facility of the Microwriter is excellent.

A modest amount of text formatting is possible. Again with command keystrokes, pre-set tabs of five characters can be inserted, margins can be indented from the left by one or more tab stops, and a line of text can be aligned to the right or centred. It is not too difficult to re-set the 15 tab stops to breaks of other than five characters.

There are other pre-set commands too. Automatic carriage return can be suppressed and line feeds to the end of the page automatically inserted. More things are possible, but for that you need to know the characteristics of your printer.

Dumping to any serial printer is by command X. Printing can be interrupted at any time. The portable nature of the Microwriter enables you to write wherever you are, then print out your work when you reach the office.

'Getting the thumb used to jumping back and forth between its two keys, and at the same time remembering what command letter options do what, is the hardest part of learning Microwriter.'

To take advantage of the facilities offered by different printers, and their different features, the Microwriter can be configured in a variety of ways, with a little help from the manuals. Default values of 60 lines at 60 characters can be altered and a form feed lines for continuous stationery programmed. All these settings are done in a menu mode.

The Microwriter can also be set up to trigger two different printer functions (bold and condensed or italic and underline, for instance). Find the relevant printer codes, follow a five step sequence of Microwriter key presses and make the settings needed. An ASCII/Hex/Decimal conversion table is printed in the manual to make setting values easier.

Most users won't need to alter settings very often. Those who do will find the alteration process a little tedious, and there is no way to store values for different printers. However, the default values are easily restored.

The Microwriter at work

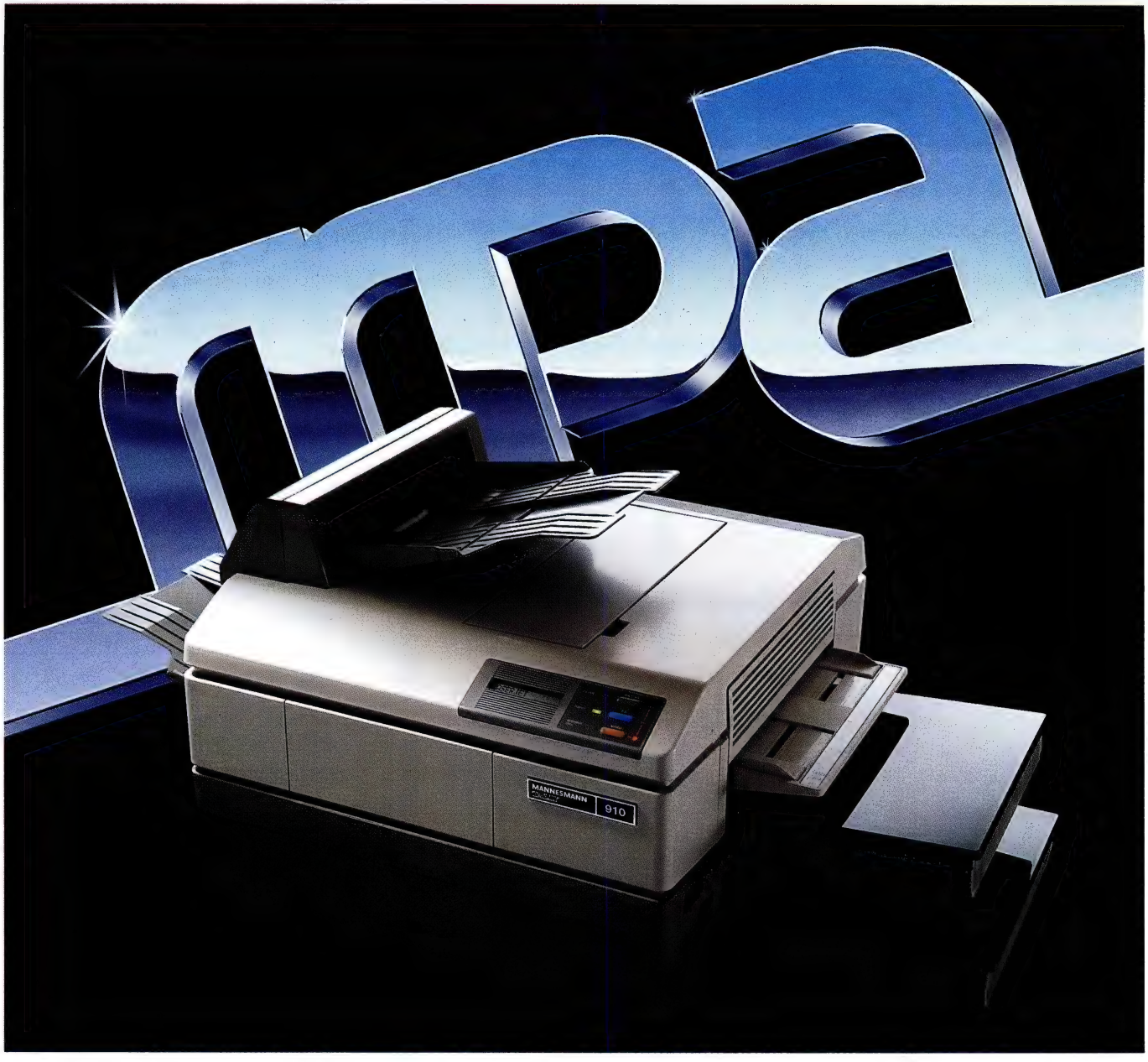
Keith Hardy is a class five engineer with Telecom in Sydney, and has been using his Microwriter for 18 months. "I don't write anything of more than two or three lines without my Microwriter," he said.

He also uses it for his work as chairman of the Staff Suggestions Committee, and as chairman of the NSW branch of the Telecom Society of Australia. "I write my monthly report for the chief engineer, and use it to write copy for the TSA's monographs."

That involves transcribing tapes of monthly lectures and turning them into articles. He sits at home, keying away, does some editing and then feeds the text into either an Apple IIe or Wang network at work, or a PC at home, for further polishing. The Wang has been configured to talk to the Microwriter. "I think it has great potential for taking origination work away from secretaries, and it means less risk of RSI for them," he says.

"I have never bothered to learn the qwerty keyboard. I feel that the probabilities of my being able to learn that as fast as I learnt the Microwriter are very remote," says Hardy. He says that it is faster than handwriting, as corrections can be made at the time of writing, and things don't have to be explained to a typist.

"I reckon it took me only a fortnight to get used to the Microwriter. It takes about a week to get into your subconscious. A colleague of mine gave it to his wife, who was a touch typist, and she was using it in ten minutes."



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Another function of the menu mode is to alter communications parameters. Again, though altering pre-set values isn't easy, it is possible.

The range of settings available is wide enough for most purposes. ASCII codes for line feed, hard and soft carriage return, backspace and line up can be set to cope with the needs of different external devices. Any Baud rates from 110 to 4,800 can be set, though the default is 1,200 Baud.

Output can be eight bits, no parity or seven bits, none or one parity, with odd or even parity. The receive wait time is another variable too.

Finally, the RS232C port can be configured to have receive and transmit enabled or disabled, the monitor interface on or off and single or double line spacing in transmitted text.

This sort of versatility opens up a world of possibilities for the Microwriter user. Communication to any printer is possible, and the device can be configured to talk to another computer,

'The Microwriter could then be used as an alternative keyboard, replacing the qwerty keyboard.'

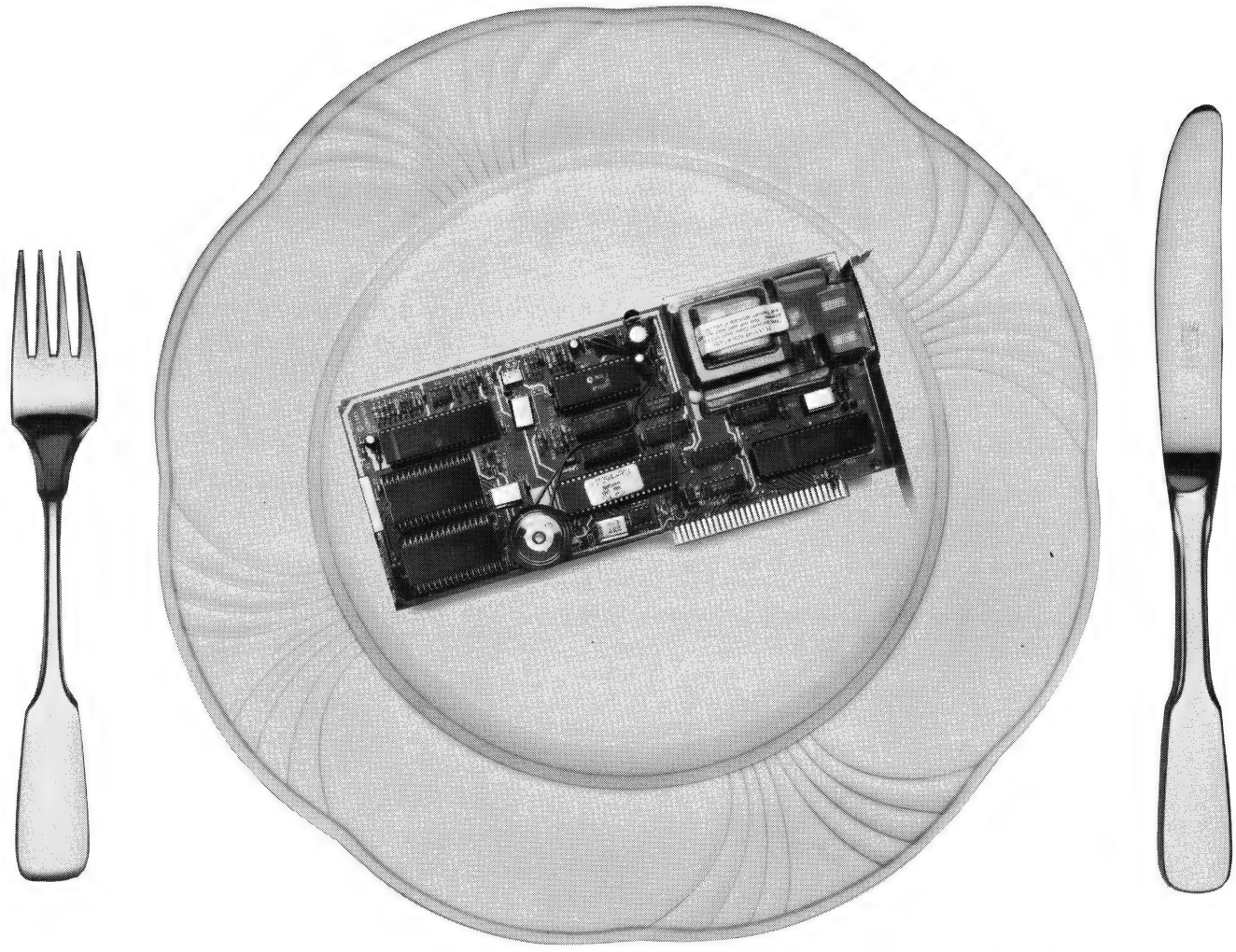
directly or via a modem, quite easily. The Microwriter could then be used as an alternative keyboard, replacing the qwerty keyboard.

It all hinges on getting used to the peculiarities of the Microwriter keyboard. There are many people who are not keyboard literate, yet need to generate text reports. The Microwriter is easy to learn and gives them the ability to be able to dump copy to a printer or another computer without having a third party key it in. Executives, scientists, sales representatives, all could benefit from the Microwriter.

The only drawback is that it is very different from anything else on the market. To somebody already quite happy with a qwerty keyboard, and not in need of portable word processing power, the Microwriter will be just an innovative gimmick. But, to somebody who is not keyboard literate, the Microwriter might just be the answer to their prayers.

END

Microwriter is distributed by PHM Australia. Tel: (02) 977 6600.



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NetComm's SmartModem 1234 is now available either as a super-compact unit that fits under your phone, or as a totally internal unit — the 1234 In/Modem (shown above) that slots into the back of your PC. Just like the new Net Comm PC In/Modem, it's totally internal — no black boxes, wiring or cabling.

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Sharp PC-1600

The Sharp PC-1600 is certainly one of the smallest computers around today, justifying its designation as a 'pocket computer'. Although it is small enough and light enough to fit in a pocket, more likely the PC-1600 will be found nestling discreetly in the back of brief cases, forgotten until called upon on the spur of some moment. Ian Davies pulls it out for a test run.

Sharp seems to alternate between calling it a computer and a calculator, but there is no doubt in my mind that the little box is wholeheartedly a computer. Sure, the distinction is difficult with programmable calculators, but when the item in question includes all the features of the PC-1600, it's just got to be a computer.

Indeed, this is the most impressive aspect of the PC-1600. Although it really is small (the same weight, and just a little bigger than my old SR-56), it is also amazingly full-featured — not only in software, but also interfaces and expansion capability.

The other major distinctive quality of the PC-1600 is that it is one of the very

few machines released in recent years which is not either an IBM clone, or a foray into new technology. Sharp would disagree with that statement, as they describe the PC-1600 as being "an electronic package of world technological firsts". It probably is, but the technology has gone into creating a full computer in a smaller package, not the usual application of technology we generally see these days: high resolution screens, icon-based operating systems, advanced graphics and so on.

Hardware

The PC-1600 consists of the core computer, plus a series of peripherals. The PC-1600 itself is a package not much larger than a programmable calculator, containing the CPU, keyboard, display, RAM, ROM and I/O ports. The peripherals are mounted in and around the 'printer' interface, a comparatively large unit about the size of the smaller 'brief case' portables, but significantly lighter. The printer interface is purely optional, as the PC-1600 remains fully functional without it.

The machine is based on a SC7852 CPU chip, which is functionally identical to the old Z80A, but is a CMOS version, and therefore draws much less power. The chip is driven at 3.58MHz, and is backed by a 1.3MHz LH5803 'slave CPU', and a LU57813P 'Sub CPU' running at 307.2kHz. What these other CPUs do remains somewhat of a mystery, but I suspect that the Sub CPU is responsible for driving the display.

The display itself is a non-backlit LCD unit with adjustable contrast. In provides four lines of twenty five characters, and can also be placed in a graphics mode delivering a resolution of 156 by 32 dots. The display quality isn't terrific, but then LCD displays rarely are. All things considered, the PC-1600 supplies a display quality about as good as many of the lap-tops, but does it in the palm of your hand.

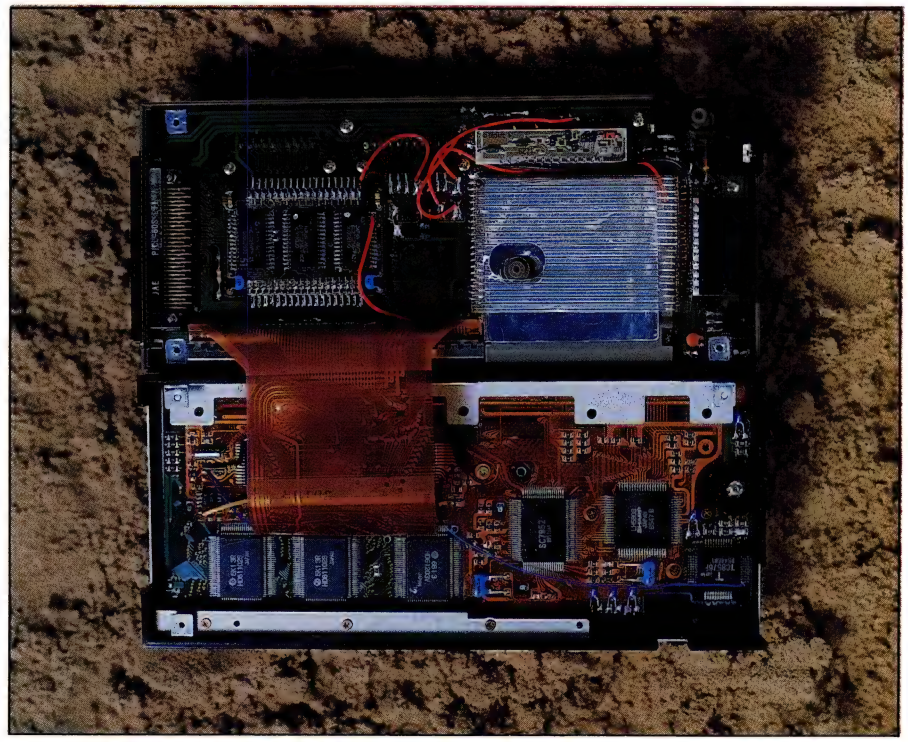
The keyboard has 69 chicklet-style keys, and is not the sort of thing to compose documents on. The arrangement of the keys is different, to say the least. With a basic qwerty layout, the PC-1600 uses the right hand portion of the key area as a calculator style pad, providing the digits and four arithmetic function symbols. This area of the keyboard can be shifted to provide access to punctuation characters. Some of the common punctuation characters, however, are found running underneath the display. These are called "function keys" by Sharp, and can be redefined to character strings accessed through

It's all there, in miniature form

pressing the DEF key, followed by the punctuation key. On the upper right side of the keyboard are the backspace keys and a second shift key, as well as the power off and power on/break keys.

The shift key itself is a little unusual, as it operates as a toggle on the next character to be keyed. For example, to access the ':' symbol, you must first press the shift key and release it, and then press the '*' key. If you change your mind having pressed the shift key, you can un-shift by pressing it again. This is rather neat, as it allows for complete one-finger operation, but it might have been nice if Sharp also allowed the shift key to be held down while keying the desired character, just to cater for those of us for whom that has become a habit. Surprisingly, however, it doesn't take long to become accustomed to the shift key as a toggle, presumably because the key area is so small and it is rather hard to get two hands going simultaneously.

Capital letters are the default with the PC-1600, but pressing a button marked 'SML' (small characters), reverses this default. The space bar is a slightly enlarged key in the usual place, flanked by scroll keys. All keys can either be



Not surprisingly, the PC-1600 sports a compact PCB

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selected to click or not click, and key repeat is also optional.

Along the top row of the display, and etched in rather than consuming a valuable display line, are a gaggle of mode indicators. These include useful things such as the shift and control states, a busy flag, mode indicators, and so on. These are rather crucial indicators, and include a rather clever low battery flag, which can either indicate the state of the PC-1600 internal batteries, or those of the peripherals.

The PC-1600 operates on four AA type non-rechargeable batteries with a power consumption of 0.48 watts. Sharp estimates battery life at 25 hours for a normal operating profile of 10 minutes processing time and 50 minutes of display time each hour. This is presumably because of the extra power required to alter an LCD display, as against just displaying static information.

The PC-1600, however, is never really 'off'. Programs and data remain in memory when the power is off, and the Basic includes a command to actually switch the machine on. This is rather clever, as it can be combined with a WAKE command to tell the PC-1600 to switch itself back on and perform some command at a particular time and date.

The Basic provided with the PC-1600 is very full featured, being not quite as good as the current Microsoft Basic, and about the level of the old TRS-80 Level II Basic. It is implemented in 96k of ROM, which includes many of the intrinsics to operate the peripherals — more on the software situation later.

The PC-1600 also comes standard with 16k of RAM, of which 12k are usable after the Basic work space is claimed. The RAM is actually upgradable to a maximum of 80k, implying a total of 176k on a Z80A, which is, again, pretty clever. Memory upgrades are physically connected through the two expansion slots on the rear of the unit.

Calling them "expansion slots" is stretching the imagination a little. How can anything which is about half the size of a match box be called an "expansion slot"? Nevertheless, that's what it is. Into each slot can be inserted a 32k RAM module. These modules are extremely well engineered. They are removed by unclipping a retaining brace and sliding the module back. As it slides back, it disconnects from the memory bus, and a small protective sleeve appears to protect the edge connector. Each module contains its own backup battery, a 3v lithium disk which lasts for two years on the shelf, or five years in the machine. Additionally, each module includes a write protect switch. You don't find engineering of such quality in desk top machines, yet here we are talking about a module which weighs about two ounces and would fill half a match box!

It was not possible to actually get inside the memory modules to see what type of technology is being used, as most of the module package is taken up by the battery, and the rest is moulded plastic.

'This is about the only area in which the PC-1600 falls down, and is the reason so many people are coming out with PC clones, or at least MS-DOS machines.'

Each module can be used either as Basic expansion memory, or as a RAM disk.

Inside the main PC-1600 casing, more fine engineering is revealed. A main PCB supports the keyboard matrix and LCD display on one side. On the other side of the PCB run the tracks and a few LSI chips. Overlayed on the main PCB is a plastic 'PCB'. This is entirely plastic with conductive tracks running through it. Four VLSI custom ICs are soldered to the 'PCB', and the 'PCB' runs across to the other half of the unit to connect with the batteries and interface circuitry. Since the 'PCB' is plastic, it provides a flexible connection between the two halves. The interface board is another double-sided PCB, again with VLSI chips. It shows that Sharp is justified in talking about the high technology which has gone into the PC-1600.

The PC-1600 is riddled with I/O ports. In addition to the two memory expansion ports on the rear, the unit has a bus expansion socket on the side for connecting with the printer and disk drive. An adaptor interface for running directly from mains power (via a transformer) is found on the rear of the box. On the other end to the printer interface are the contrast knob, and a plethora of ports.

'No space is given to the general topic of programming, and this is a little strange when one considers that people will not be buying this machine to run canned applications.'

First, there is an RS-232C port. Now, I know I have used these pages in the past to complain about manufacturers who implement the standard RS-232C port in such a way that it isn't really a standard at all, well the PC-1600 is another machine with a 'Claytons' RS-232C port — but one must make some allowances for a machine of this size. For a start, the RS-232C port has physical incompatibility. It isn't a 25 pin D type connector. It isn't even a 9 pin or 15 pin D type — none of these would fit inside the case. To be honest, I don't quite know what you would call it, except "small". The good news, however, is that Sharp can supply an interface cable with a normal RS-232C connector on one end. The other incompatibility is electrical. True RS-232 uses +12v and −12v signal levels, and there is no way Sharp can generate these levels from a 6v power source. I'm sure that the average user would not be keen on carrying around a couple of car batteries just to generate the correct signal levels. This means that once you have purchased the 'Sharp RS-232C to real RS-232C' adaptor cable, you still may have some trouble communicating with another machine or with a modem. The safest thing would be to ensure that your intended communicant accepts TTL levels in place of true RS-232C. Many devices do this, including Sendata modems. Other devices including most PCs, require at least something close to the standard voltage levels.

A so-called 'serial I/O' port is also provided, which is specifically for optical fibre communications, and can run at up to 38.4k/sec. Since few users would, as yet, be into optical fibre, this may only be of limited use. Interestingly, the third port is an analog input, and the PC-1600 contains a built-in analog to digital converter. The port can handle a maximum input of 4v, and can register voltages in the range 0 to 2.495v. The analog input is converted to a byte value, thereby providing 256 discrete levels. Accuracy is 3%, which is pretty good, considering the whole thing is built into a hand held computer. The Basic, which we will be looking at later, includes interrupt support for both the communications ports and the analog port.

The PC-1600 comes complete with a soft case, batteries and operations manual.

Peripherals

External expansion starts with the addition of a printer and cassette interface. This unit is smaller than most lap-top computers, and acts as the harness for all additional expansion.

The PC-1600 itself slots into and becomes an integral part of, the printer interface. The reset button found on the rear of the PC-1600 is duplicated on the rear of the printer interface, since the rear of the PC-1600 becomes inaccessible once mounted on the interface. Again, well engineered, except for the fact that if you turn the printer interface upside down to get at the reset button, the paper falls out of its mounting and runs all over the floor. Oh well.

The printer interface itself weighs just 1.6 kg, and includes its own rechargeable batteries. The most distinctive feature of the interface is that it's just about empty!

In many portables, the batteries are the largest and heaviest item. In the printer interface, you actually have to look hard to find them. Sadly, this also says something about battery life. With a fully charged battery the printer has enough juice to print 250 full lines of text. Not much, but with an average print speed of 5 cps, this equates to 30 minutes of continuous use. Fortunately, the printer can run directly off the recharger provided, as incidentally, can the PC-1600 itself.

The printer is actually a four pen plotter with bi-directional paper feed, which means you can also use it for charts and diagrams. All of the firmware for the printer is in the PC-1600, which means that the Basic supports the printer rather well. Character size is selectable from 17 to 160 characters per size, with heights from 1.2 to 10.8 mm. Resolution of the print head is 0.2 mm, with good horizontal repeatability, and slightly worse vertical repeatability. The printer mechanism itself is really just a couple of motors and a few pens — all the rest is in the PC-1600.

Printer controls on the top of the case include a paper feed switch, reverse feed, pen change and printer off switch, all of which are also accessible under software.

The interface also includes a cassette interface, which provides the standard 'mic/ear/remote' jacks to a normal cassette recorder. This might be a good cheap alternative form of data storage for many users, but after years of using cassette based storage mechanisms, I can safely say that there's nothing like a disk drive. Once again, the cassette interface is almost nothing — just a relay, a couple of diodes and a few resistors. It is almost surprising that Sharp did not squeeze these into the PC-1600 — there are a spare couple of millimetres!

The printer/cassette interface comes complete with a carrying case, recharger, paper, four pens, cassette cable and paper holders.

I really doubt that anyone will actually use the cassette interface, as there is a very reasonably priced disk drive available for the machine. A tool pocket on the printer interfaces is unclipped and thrown away to allow mounting of the disk drive. The drive takes its power from the rechargeable batteries in the printer interface and as seems usual for this gear, contains almost nothing except the drive mechanism and modulator. All the smart bits are in the PC-1600.

'The manual even implies that you're on your own when it comes to software.'

The drive is a 2.5 inch microfloppy, and is the smallest capacity microfloppy around, holding a meagre 64k. Since it is unlikely that the PC-1600 will be used for running corporate databases, this low capacity may not prove to be a problem. The drive formats to 16 tracks/side, and since the drive is only single sided, economically minded owners could use 'flippies' — that is, a floppy which you take out and flip over. This is generally a bad idea, however, as causing the disk to rotate in both directions can increase wear and dust distribution.

The disk drive consumes 2.5 watts (when in use), and weighs in at just 470 grams. The disk runs at quite a respectable speed, with most programs loading in just a couple of seconds. Unfortunately, the disk cannot be connected directly to the PC-1600, it must run in conjunction with the printer/cassette interface.

Both the printer/cassette interface and disk drive take their power on/power off cue directly from the PC-1600. That is, neither has its own power switch. Turning the PC-1600 on automatically turns on the peripherals.

Software

This is about the only area in which the PC-1600 falls down, and is the reason so many people are coming out with PC clones, or at least MS-DOS machines.

The PC-1600 runs only Basic, and the operating system is integrated with the Basic interpreter. No other software is provided with the machine (although the review machine did have some rather dubious demo software) and, to my knowledge, no software is available. The manual even implies that you're on your own when it comes to software. Due to the rather neat RAM expansion ports, however, I wouldn't be too surprised if some plug-in application packs started to appear in the near future.

The Basic interpreter is really very good, supporting the available hardware to the full. As well as providing all the usual Basic facilities, plus a calculator mode, the PC-1600 also has 22 disk commands, 15 communications commands, including interrupt driven I/O, 3 analog port commands, including an interrupt upon 'out of range' statement and 20 commands for the printer.

The Basic also includes full facilities

The PC-1600 slides neatly into its printer interface

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In perspective

In many ways, the Sharp PC-1600 is a step into the past. Its Basic interpreter seems about 1978 vintage jazzed up with some peripheral support; it's lack of error messages dates back to a time when 96k of ROM was unheard of; it makes radical departures from the emerging standards; and it offers no software.

Sure, the lowliest PC clone is better in every way, except you can't fit it in your pocket.

It is a firm law of technology that only yesterday's state of the art is available today in low power versions, ultra-small or ultra-cheap. You can even see this in the evolution of VLSI chips, how the number of support chips required oscillates every two generations. First they build a really clever chip which needs lots of support components; then next generation they get even smarter and fabricate the support components on the same chip; then in the next generation they want to add all sorts of functionality so the support components get thrown off the chip into separate packages again. And so it goes on.

Two years from now, a machine the size of the PC-1600 will be running MS-DOS and Lotus 1-2-3. But technology will have moved on, and we'll all stand around looking at it, shaking our heads, criticising the dreadful 200 by 640 graphics, and the limitations of 16 colours. We'll all have desk top machines with million point graphics and 32,000 colours. Two years after that, the handhelds will have million point graphics, and the desk tops will have billion point graphics. And so it goes on.

It's life. You can either utilise today's technology by having lots of extras on the top of your desk, or by having yesterday's proven technology in the palm of your hand. It depends on your needs.

The PC-1600 must be one of the most powerful and most portable computers around today, and if that's what you need, then the PC-1600 is for you. It will cost you, however, nearly as much as a good PC clone.

If you want a computer to have and to hold, then the PC-1600 is probably not for you. It isn't really a pleasure to work with — the keyboard is very small, as is the screen. It's not the sort of computer you feel entirely comfortable with.

I can see the PC-1600 used by large organisations as data acquisition units, going around in the field accumulating information in its non-volatile memory to pass to some larger computer back at headquarters. I can also see it being used as a black box for field operators, programmed by head office so that the man in the field can plug in two or three factors and get an answer on the spot. I can also see it being purchased as a status symbol. However, I can't see it being bought by individuals who want a computer for the sake of having a computer — one to play with and one to learn on. I also can't see someone buying it to run accounts or prepare articles remotely. This is most definitely the travelling man's computer.

Would I buy one? No way — I prefer the extras on the top of my desk, and am prepared to live without the luxury of carrying my extras around in my pocket. However, there would be many engineers, sales reps and estimators who have to perform 'on-site' who will be drooling over this machine.

Technical specifications

Processor:	Z80A compatible running at 3.58 Mhz
RAM:	16k standard, expandable to 80k
ROM:	96k
Keyboard:	63 key
Display:	25x4 lines, text mode
	156x32 dots, graphics mode
I/O:	RS-232C
	Optical Fibre
	Analog
	System expansion bus
Language/OS:	Basic
Size:	195 × 86 × 25.5 mm
Weight:	390 grams including batteries
Peripherals:	Disk drive
	Printer/plotter
	Cassette

for making use of the graphics ability, both on the printer and screen. The only negative aspect of the Basic is that it seems a little behind the times in some of its intrinsic features. For example, variable names are only significant to two characters, and arrays may only be a maximum of two dimensions. It looks to me like a very old Basic which has been jazzed up to support the PC-1600 hardware. If this is the case, Sharp has done an extremely good job of it, as the Basic seems so full featured that some of its 'less progressive' aspects are barely noticeable.

One very annoying feature, however, is that the Basic is always in one of two modes: Run or Program. In Program mode, you can't run programs. In Run mode, you can't list programs to the screen or edit them. It is constantly necessary to switch between modes, and you're forever in the wrong mode. I can see no reason for this mode switch, as it merely seems to switch off the facilities which would be available in the other mode, not reassign keys or commands. It ends up being a pain in the neck, even though you do get used to it eventually.

Additionally, no communications software is provided with the machine. This is a real pity, as in most applications for which the PC-1600 would be used, communications would play a vital role. Of course, it's easy enough to write your own communications software, especially with the excellent Basic, but it would be better if Sharp produced a plug-in applications pack.

One last negative is that no error messages are produced. I find this really quite surprising in a 96k ROM, but only error codes are displayed. Whenever anything goes wrong, such as a syntax error, trying to run a program from Program mode, or trying to edit a program in Run mode, the Sharp PC-1600 only gives you a two digit error number, and it is necessary to run off to the appendices to look it up. I thought those days were over.

Finally, the Basic is not terribly fast, as

Benchmarks

BM1	3.5
BM2	12.7
BM3	37.1
BM4	37.7
BM5	40.4
BM6	61.1
BM7	85.7
BM8	531.4
Average	101.2

For a full listing of Benchmarks see End Zone.

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you can see from the benchmark timings. This is partially unavoidable since the interpreter does not support integer type variables — just real numbers and strings.

Documentation

The documentation is generally excellent. Separate manuals are provided for the PC-1600, printer/cassette interface and disk drive. Really only the PC-1600 manual is essential, as it seems to cover everything in the other two. More, in fact.

Full sections are provided on each peripheral, with introductory sections on general care and running of the machine. The largest section is the Basic language reference, an alphabetical description of every command and function. No space is given to the general topic of programming, and this is a little strange when one considers that people will not be buying this machine to run canned applications. Essential for any machine with non-standard ports, the manual includes full pin-out specifications.

The only thing which could really be added is a quick reference guide. The manual is far too big to fit in your pocket, but since the error codes are in it, it really becomes necessary most of the time. A small pocket size reference card with syntax summaries and the error codes would be a welcome addition.

Prices

The PC-1600 itself costs $650, with another $650 for the printer/cassette interface. The disk drive is quite cheap at $395, and the 32k memory modules sell for $295 each — a lot to pay for 32k, but probably the smallest 32k you'll see for quite a while.

Conclusion

Sharp has certainly done something rather clever with the PC-1600. The company has all this high technology carefully hidden inside the case and entirely focused on making the machine small enough to fit in your pocket.

If you need truly pocket size computing power, the Sharp is well worth a look.

END

'I think it's found the formula, sir.'

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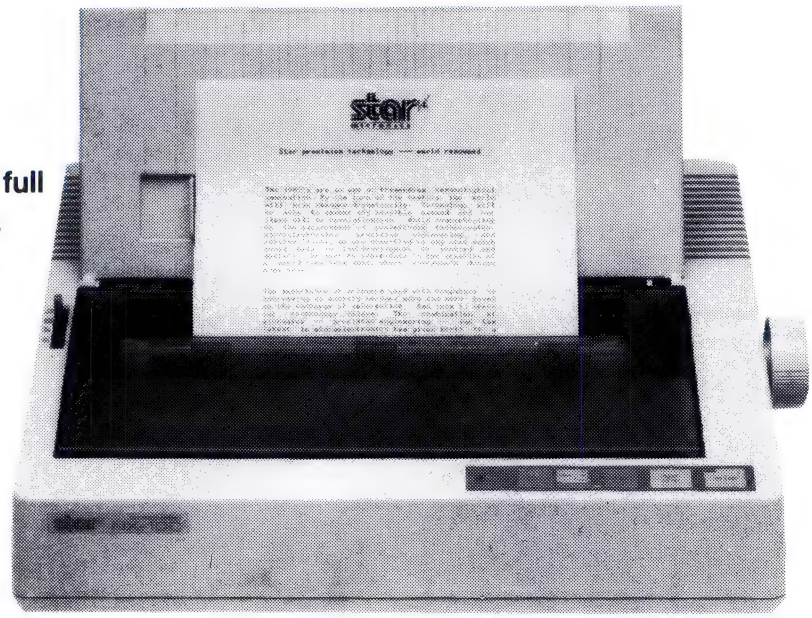

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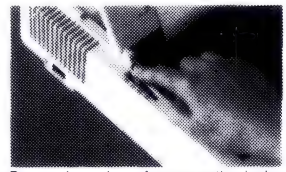
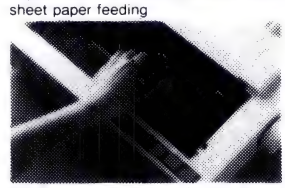


Paper release lever for automatic single-sheet paper feeding



Ribbon cassette is simple to replace and eliminates mess.

Automatic cut sheet feeder.

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Print Method	Serial Impact Dot Matrix
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Printing Direction	Bi-directional, logic seeking (Text mode) Uni-directional (Bit Image and NLQ mode)
Number of Head Pin	9
Character Set	NLQ character set: Upper-and lower-case letters, numbers and symbols Draft-quality character set: Upper-and lower-case letters, numbers, symbols and block graphics
Line Feed Spacing	1/6, 1/8 and n/216 inches
Paper Feed Method	Friction and Push Tractor Feed
Paper Feed Speed	2.7 inches/sec.
Number of Columns	normal pica 80 (40) normal elite 96 (48) condensed pica 136 (68) condensed elite 160 (80)
Interface	Commodore Serial
Paper	Cut Sheet 7 –8.5 Fanfold 4 – 10
Ribbon	Original Ribbon Cartridge (Black)
Dimensions	400 (W) × 336 (D) × 104 (H) mm
Weight	6.8 kg
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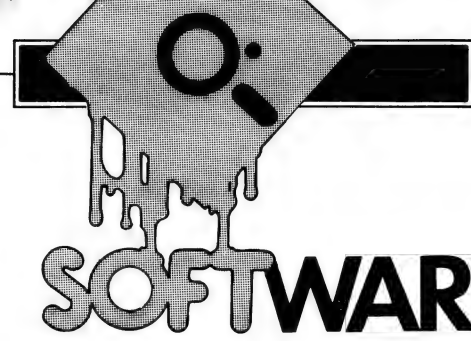

Take your pick

The Pick operating system combines power and friendliness in data handling and retrieval. Long neglected by users, Roger MacNicol feels it is now getting the recognition it so rightly deserves.

The established wisdom at the moment is to choose your software first, and then choose a computer that can run it. One of the most important types of software for commercial use has proved to be databases — potentially freeing people from drudgery, and enabling managers to access needed information faster and more efficiently. The range of database software for desk-top computers is enormous, and the almost monthly reviews of new database products show the speed at which this choice is increasing. But each of these programs will be limited to a greater or lesser extent by the fact that they must run under an operating system which generally has to be 'a Jack of all trades but Master of none'. Just consider the major categories of software available under MS-DOS: word processing, databases, graphics, communications and number-crunching. So why not try a different approach? If the software and the operating system are so mingled together that they lose their distinct identities, the system can then be optimised to get the maximum power out of the chosen hardware. This is the strength of the Pick operating system.

Development

Pick has been around for many years, but only really took off in 1979 when a number of Pick look-alikes began to emerge. It has already found widespread use with the police, the health service and local authorities because of its unparalleled combination of power and friendliness in data handling and information retrieval. If Unix is the software developer's dream, then Pick can be seen as the businessman's dream.

Pick provides a powerful relational database, with an easy-to-use query language that enables the user to interrogate the database in a very natural syntax; it also provides a version of Basic called Pick/Basic which is extensively enhanced and is highly integrated with Pick's sole file structure. Pick was designed from the outset to be a virtual memory system; Pick *sees* the RAM and the hard disk as one single unbroken expanse of memory, and it is inherently a multi-user, single-tasking environment. Pick also provides comprehensive security at both the user and file levels.

The Pick operating system began life in 1966 at TRW Systems, where it was developed for the US Army Cheyenne helicopter program, under the name GIMS (Generalised Information Management System). It was accepted by the US Army in 1969 and implemented on an IBM 360 series mainframe. At the end of that project one of the original team from TRW Systems, Richard Pick, was allowed to continue development of a commercial version, which first saw light of day in 1973 on a Microdata 8-bit mini under the name REALITY. The nature of the Pick system has remained essentially unchanged since this implementation.

Design

Pick's design centres around a four-level hierarchical structure made up of successive one-to-many relationships: a system dictionary which defines the way that the system is partitioned between different users (each partition is known as an 'account'); each account then has a master dictionary which defines both the physical location and the logical design of the file; finally, each file may have several data levels which hold the required information (see Fig 1). An important consequence of this design is that all data is stored at the same logical level in the system.

All the memory used for data (both RAM and hard disk) is divided up into 512 byte 'frames'. A new file is started by assigning a number of 'groups' of frames to hold the data, (known as the file's 'modulo'). The number of frames in each group must also be specified at the time of the file's creation (known as the file's 'separation').

When we wish to store an item in the file, its key is mathematically manipulated to decide uniquely which group to store it in (hashing). The resultant file structure is known as a keyed random access file.

Each item in the file can be further sub-divided into three one-to-many relationships: attributes, values and sub-values. Fields in the item are known as attributes. The successive attributes in the item are simply concatenated together, separated by the high-bit byte $FE. Each attribute may be broken down into many values separated by the byte $FD, and in turn each value may be broken down into many sub-values, separated by the byte $FC. In practice sub-values are rarely used, and at a recent keynote address at the Spectrum Trade Show in Las Vegas, Richard Pick said he knew of no case where the data structure made the use of sub-values mandatory. This variable length data structure is consequently very efficient

on storage space with no wasted space and an overhead of only one byte per delimiter. The only limit in the current release of Pick is that the total size of each item must not exceed 32k.

When an item is saved, it is always added at the end of the group, and if it is replacing a previous version of that item, the rest of the group is moved up. When a group is full, the operating system will assign another frame from the overflow table and link it to the group. When a group shrinks, the spare frames will be released again to the overflow pool.

The advantage of this structure is that the time taken to retrieve a record is largely independent of the size of the file, since you can always go straight to the group that holds the required record. This makes Pick ideal for large applications such as library catalogues.

Now we have a picture of the physical file structure, let's go on to look at the logical file structure that makes Pick into a relational database. The dictionary of a file is similar to the data levels in structure in that it is simply made up of a number of items containing attributes, and in some cases multi-valued attributes. There are two kinds of entries in the file dictionary: there will be an entry pointing to the memory location of each data level, specifying which frame the file starts on, together with its modulo and separation; and there are data-defining items.

The data-defining items can be further divided into two types: attribute definitions, giving a name to the contents of an attribute, and derived data, where the contents of the attribute have been manipulated. Either of these may have synonyms defined in the dictionary to cover alternative spellings and abbreviations.

Pick's enquiry language, known as Access, uses these data-defining terms and synonyms to select, sort and list the data when requested.

Access: Access allows the user to interrogate the database in a very powerful and flexible way. As you might expect, all the words available to the user are dictionary-defined. The account's master dictionary defines the verbs such as SORT, SELECT and LIST; the connectives such as WITH, AND and NOT; and the names of the files in that account. The file's dictionary is used to define the logical correspondence between the name of an attribute and its physical location in the item (for example, SURNAME may be defined as the contents of attribute 3).

The advantage of this is that you can tailor the language exactly to your own requirements and colloquialisms. If you want to say 'Give me . . .' rather than 'Sort . . .', you would simply specify GIVE to be a synonym of SORT, and ME to be an ignored word.

Access sentences are built up of verb — filename — selection criteria — sorting criteria — attributes to print — general format control. After the verb

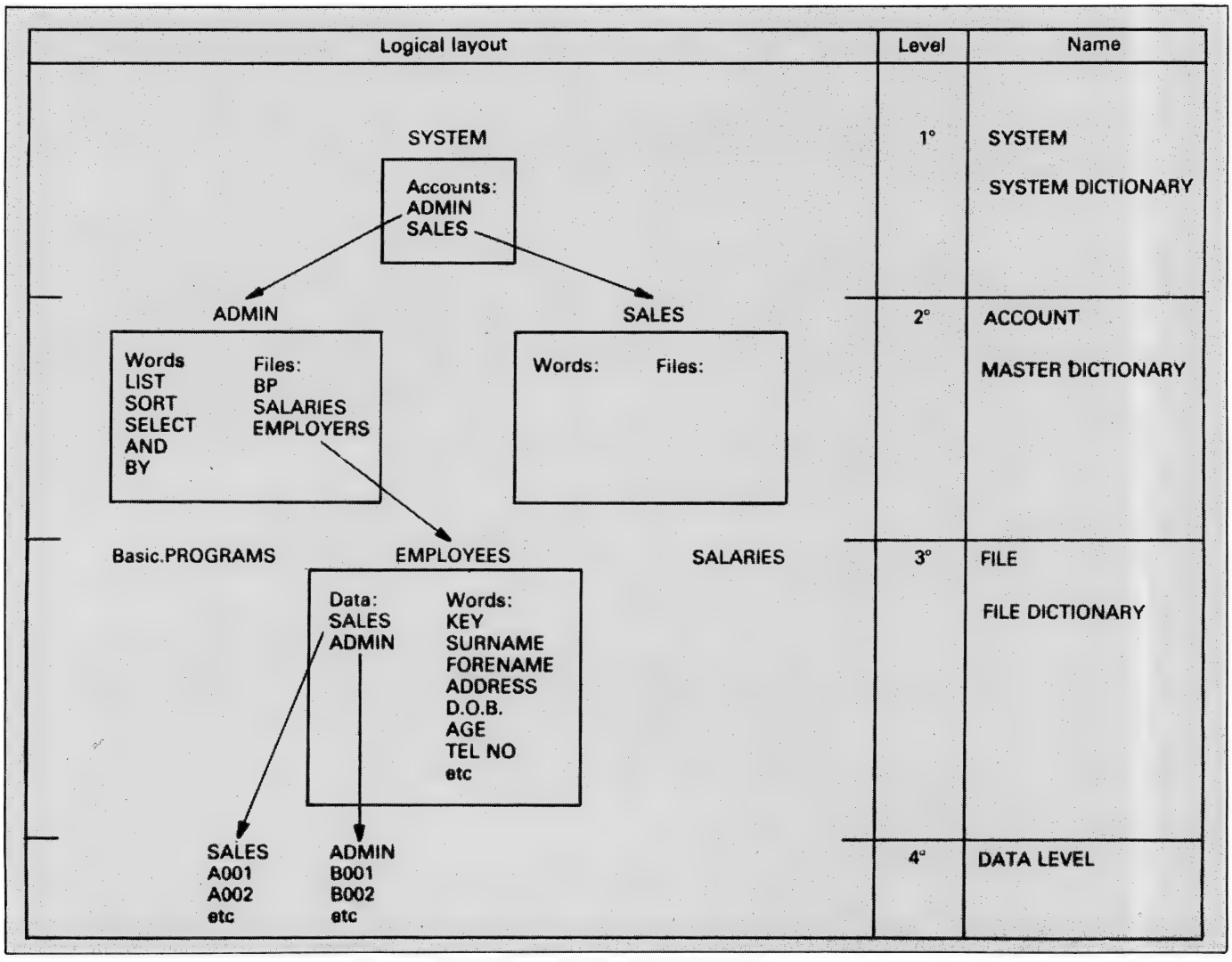

Fig 1 The four-level heirarchy

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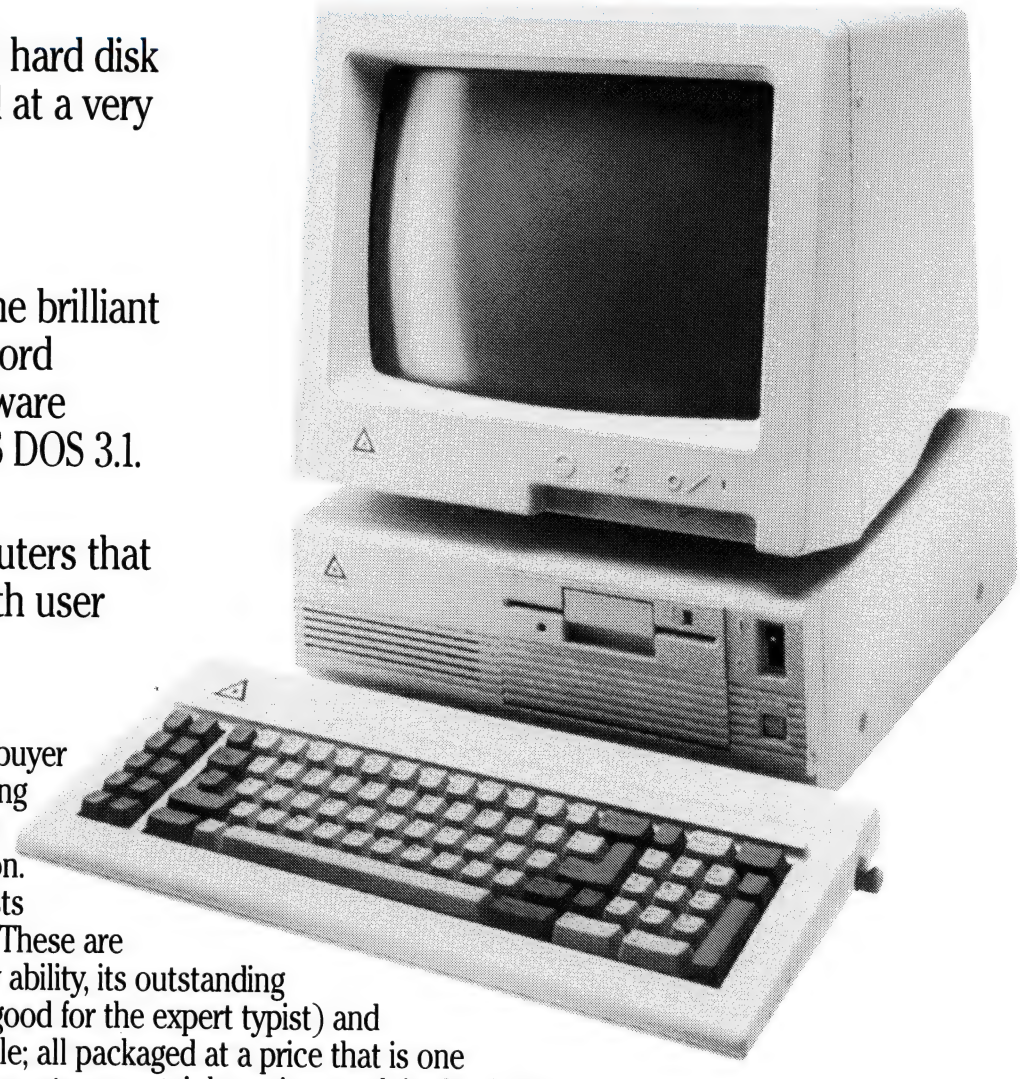

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and filename, the syntax of the sentence is completely free. Any dictionary data definition may be used for sorting, even when the data represented has been derived. The results of a SORT or SELECT may be stored in order to give serial access to a file or to part of a file. More complex sequences of actions may be built up in command files called 'procs'. Procs may also be used to pass the results of sorts and selections through to Basic programs. The proc language is built up of unreadable one-letter codes, and is far from friendly.

Let's see how Access works out in practice, taking for our example an 'Employee' file, with one item for each employee. Because each item in a file is stored and retrieved by its key, the key must be unique. Since we cannot guarantee that every employee will have a different name, we could choose a simple alpha-numeric key which could be assigned sequentially. We might then decide we needed to store an employee's surname, forenames, address, telephone number, date of birth, date of joining the company and an internal pay code. Multi-values can be used to store successive lines of the address, or list different phone extensions to try. Fig 2 shows how the logical file structure might then be arranged. If the file was called EMPLOYEES, a typical Access sentence might be: SORT EMPLOYEES BY SURNAME WITH D.O.B. BEFORE "1 JAN 1926" SURNAME FORENAME D.O.B., which would produce a sorted list of all employees over the age of 60 giving their names, addresses and dates of birth. The Access sentence: SELECT EMPLOYEES WITH PAY.CODE "SA" would produce an unsorted list of all the company's Systems Analysts in the pseudo-random sequence defined by the hashing algorithm. The verb SSELECT would produce sorted selections.

Dictionary definitions allow the data to be processed in a variety of ways. This processing may be specified at either or both of two stages, resulting in the data being held in three distinct forms. The first form is the raw data on the disk. When this data is read, it passes through a 'correlative', to produce the internal form. This internal form is used for sorting and selecting items. The second stage of processing occurs when the data is output to the screen or printer, and is called a 'conversion'.

Pick encourages the user to store data in a raw form. Numbers are stored as integers, and the date is stored as the number of days before or since 31 December 1967. This means that sorts, which use the internal form of the data and are based on the ASCII sequence, will always produce the correct result. Conversion codes are then used to control the position of the decimal point in numbers, and the desired format of the data. Although any of the processing commands may be used at either stage, conversions ought only to be used when they are bi-directional without loss of information, because the same code is used as an input conversion to change your sorting or selecting criteria to its internal form.

The richness and power of Access

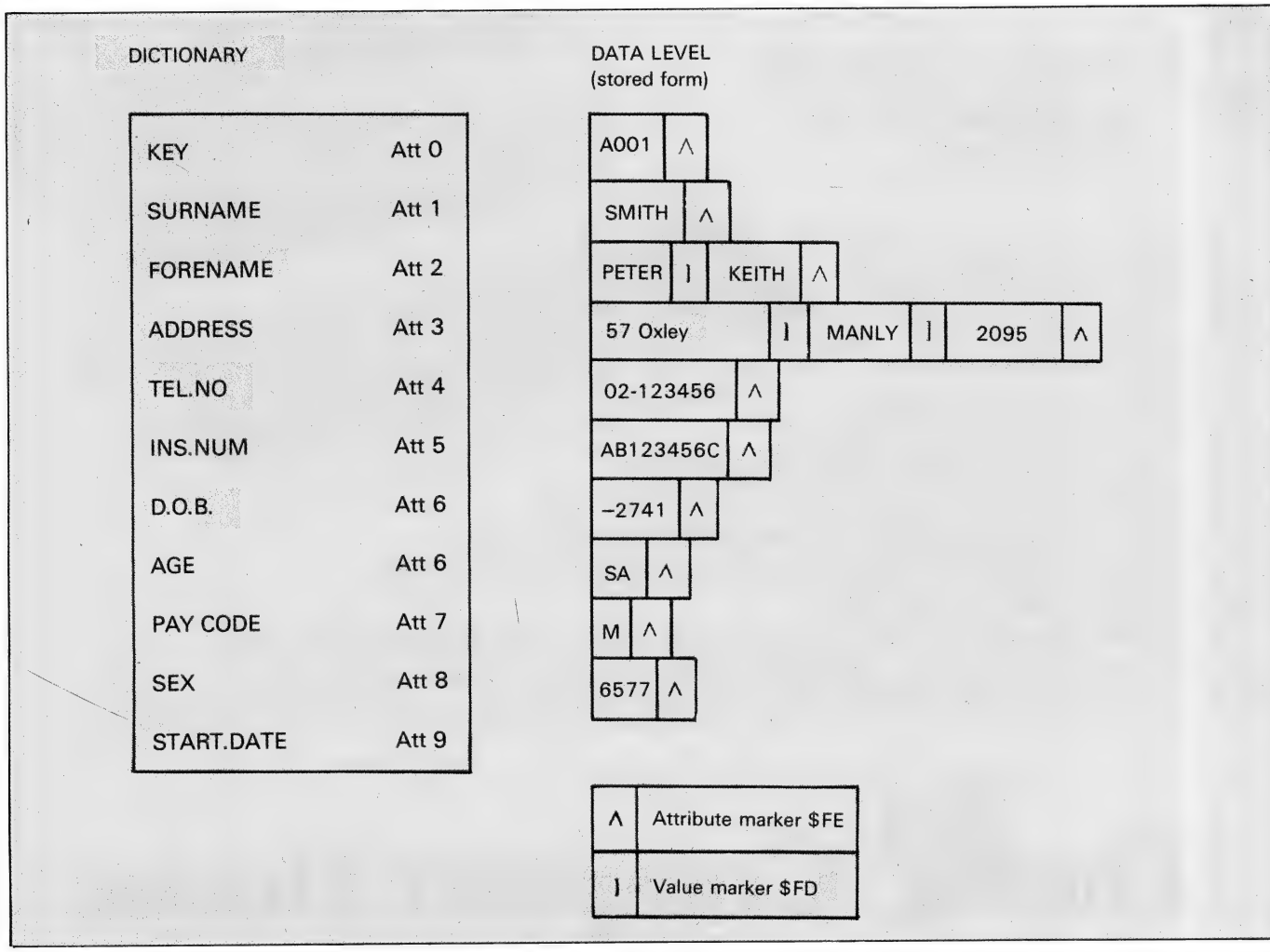

Fig 2 The dictionary for the EMPLOYEES file and a sample item

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derive largely from the use of correlatives, of which the three most common types are 'F', 'A' and 'Tfile'.

'F' correlatives are specified in Reverse Polish Notation, and can be used for both mathematical and text manipulation. We could specify a dictionary item for AGE based on the stored date of birth. If the DOB was held in attribute 6 of the item, a simple correlative for AGE would be "F;6;(DY);D;(DY);−;6;(DJ);D;(DJ);›;+". We could then SORT or SELECT the EMPLOYEE file by AGE, or print the AGE in a listing, just as we could with the raw data — the date of birth.

Tfile correlatives extend the use of the dictionary from merely providing meaning for a single file, to a 'window' onto the whole database from the point of view of its primary file. We could use the PAY CODE to look up the current salary of an employee from a table. This means that if the salary is changed, it only has to be changed in one place — the table, and not in the record of every employee on that grade. A dictionary definition pointing to the same attribute as PAY CODE, called SALARY, could be specified to look up the salary from the SALARIES file, with the correlative "TSALARIES;V;;1".

Access provides simple verbs for adding up attributes which are listed. If SALARY were specified as an attribute to be added up, and the EMPLOYEES file were sorted by DEPARTMENT, the listing would then give us the total annual wage cost to the company of each department.

'A' correlatives differ from 'F' correlatives by allowing the user to refer to data by its dictionary name. If we had stored the net cost of an object under the name NET.COST, a dictionary definition for the total cost with sales tax could be specified by the correlative AN(COST) *120/100. 'A' correlatives tend to be the most readable of the different types.

With Access the user can specify complex processing of the data, and refer to it by a single word in a sentence. This gives Pick one of the easiest and friendliest ways of getting information out of the database of any system.

However, Pick's major weakness comes in getting the information into the database. To do this you can use the crude line editor provided with Pick which is fine for programming, but of little use to the businessman, or resort either to programming in Pick/Basic or using one of the many excellent application generators available. Most Pick machines come with an application generator built in, either an in-house one like All on Microdata product or a bundled commercial package.

Pick/Basic: Unlike most operating systems where a variety of languages are available to the user, Pick only supports Pick/Basic. In keeping with the overall philosophy, this is a dialect of Basic which has been extensively enhanced so that it completely reflects the data structure provided by Pick. As well as the usual real arrays, dynamic arrays are supported. A dynamic array can hold a complete item, together with its attribute, value and sub-value markers, and is represented by chevron brackets: VAR‹2,3› would mean the third value of the second attribute of VAR. Basic statements are provided for inserting elements into the middle of a dynamic array pushing all the other elements up, for deleting elements from the middle of a dynamic array, and for sorting the elements of a dynamic array.

Unlike most other Basic dialects, Pick does not distinguish between string and numerical variables, so items can be simply built up by concatenating the data together with the right markers, before being written away to the file.

As a dialect, Pick was years ahead of the work done by Acorn in incorporating many of the facilities for structured programming usually associated with Pascal. It provides the CASE statement to replace multiple IF statements. It also provides a choice of LOOP UNTIL and LOOP WHILE, as well as providing UNTIL and WHILE extensions to FOR NEXT loops. This choice allows the programmer always to choose the most natural way of expressing the structure of the program.

Pick look-alikes

You may wish to ask: 'If Pick is so good, and has been around for this long, why isn't it better known and more popular?' The answer is probably not, as has been recently argued, 'that Pick is not sexy enough', but is partly historical, and partly reflects the nature of the business market. The first problem that beset Pick was that Microdata was taken over by McDonnell Douglas. This led to Richard Pick leaving Microdata to form his own company, then called Pick & Associates. This new company implemented Pick on the Honeywell Level 6 (under the name of Ultimate), which led to a royalties lawsuit which dragged on for several years.

The second problem was that Richard Pick has always tried to keep the development of Pick under his personal control. All true Pick implementations have been done by Pick and his team, and a Pick source licence will cost the hardware manufacturer around 20 times the cost of a Unix source licence. Pick Systems also turns down many requests from hardware manufacturers to implement Pick on their machines.

Revelation: With the decreasing cost of computing power, Pick has become available on successively smaller machines. Pick Systems has released true Pick for the IBM/XT and AT, and Cosmos Inc has released Revelation for both generic MS-DOS and PC-DOS machines. When Revelation was released in 1984, reviewers clearly found it difficult to categorise (see *APC* May 1984). Technically it is an overlay operating system, which means that it sits alongside MS-DOS, and uses MS-DOS for reading and writing to the disk. If you review it as an operating system you turn people off; yet it doesn't fit well into the category of database software because it provides so much more.

Revelation has several distinct advantages over Pick on the PC. Pick needs a partition of the hard disk all to itself, so when you are running it any files and programs you may have on the DOS partition are not available to you. But since Revelation sits alongside DOS, you can easily swap information between DOS and Revelation applications. Utilities are provided to upload your old dBase II and Lotus 1-2-3 files into Revelation.

Revelation will run happily under Microsoft's Windows, which means that you can run an application under Revelation and a word processing package under DOS simultaneously in different windows on the screen, and swap information between them.

The most exciting advantage of Revelation is the improvement of its presentation over Pick. The explosion of desk-top computing has resulted in many improvements in the ease of use of applications by non-technical people. Revelation succeeds in bringing together minicomputer power, in the sense of being able to express and manipulate more complicated data structures, with the friendliness that people have come to expect from desk-top applications.

Two good examples of this are Revelation's handling of procs and correlatives. In Pick, each of these uses a different set of unreadable one-letter codes. In Revelation, correlatives have been replaced by writing an unlimited amount of Basic code into the dictionary definition, which makes them potentially much more powerful. It also enables some standardisation between the dictionary and applications. Procs have been replaced by a PERFORM statement in Basic, which allows any MS-DOS or Revelation command to be called.

When it comes to getting data into Revelation, Cosmos has improved on

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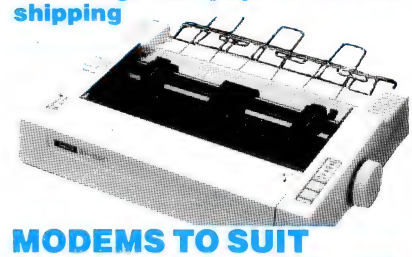

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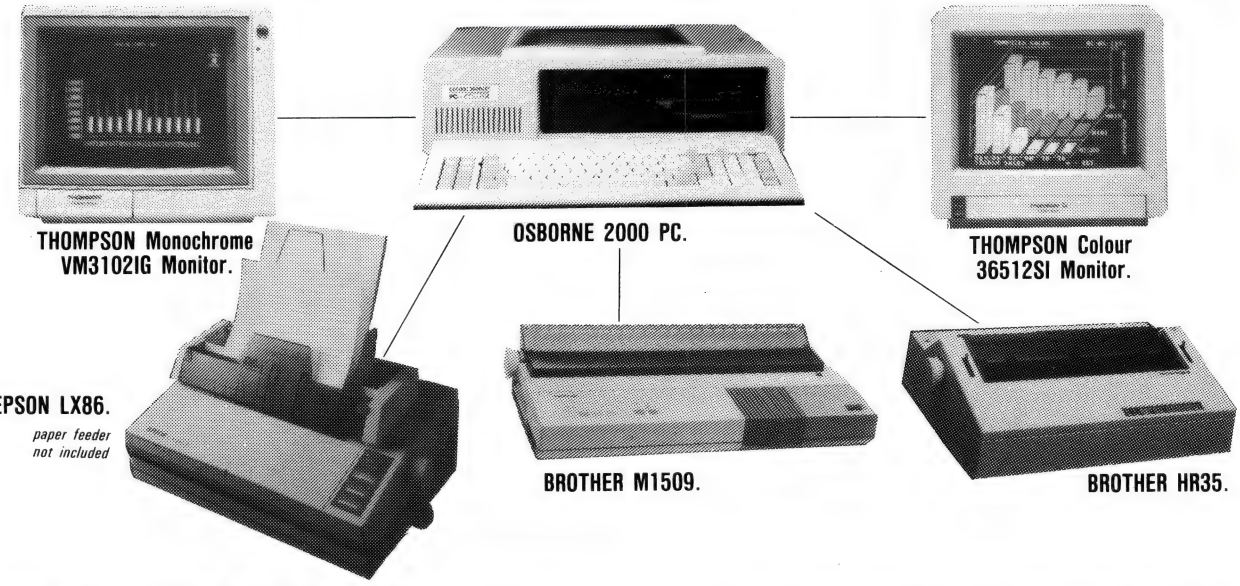

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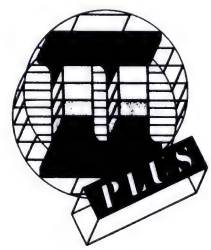

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Pick by providing a full-screen editor, and a simple application generator called R/Design. For people who want a more powerful generator, or who wish to run the same application on Revelation that they have running on their Pick machines.

Revelation probably provides the most powerful and flexible environment for handling data yet available under MS-DOS and PC-DOS, but you will need at least 512k RAM and a hard disk. An 8087 co-processor will speed Revelation up by around 20 per cent. Revelation costs $1400.

Uni-Verse: Over the last few years Unix has, like Pick, become available on successively smaller machines. Several commentators have perceived them to be competitors and written comparative reviews, but each has very different strengths. Unix provides a much better environment for communications and number-intensive applications; it also provides a wide variety of languages, but it cannot begin to compete with Pick on the suitability of its data structures for the businessman, or on its friendliness. Pick is a much more mature system. This debate may now become irrelevant with the release of uni-Verse from VMark which provides the full Pick environment on any Unix system V machine.

Uni-Verse comes in four flavours *(sic)* to enable existing Pick applications to be easily transferred: true Pick, Prime Information, Microdata's Reality and Ideal for standard uni-Verse. A uni-Verse account corresponds to a Unix directory, and each account must have its flavour defined at the time of its creation. Users of uni-Verse are encouraged to use Ideal-flavoured accounts which provide several enhancements to standard Pick. Like Revelation and Prime Information, uni-Verse is an overlay operating system, which means that all of Unix is still available to the user, and Unix processes can be called from within uni-Verse.

The release of Revelation and uni-Verse considerably extends the range of hardware that can support the Pick environment. It also means that the user can have the same application running on his desk-top micros and mini-computers, and swap information between them.

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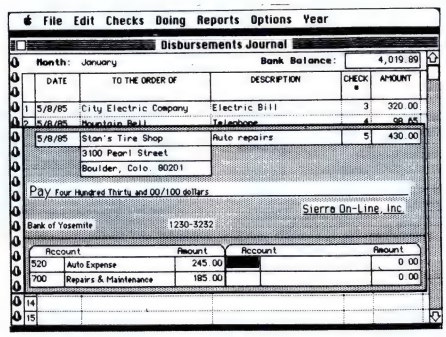

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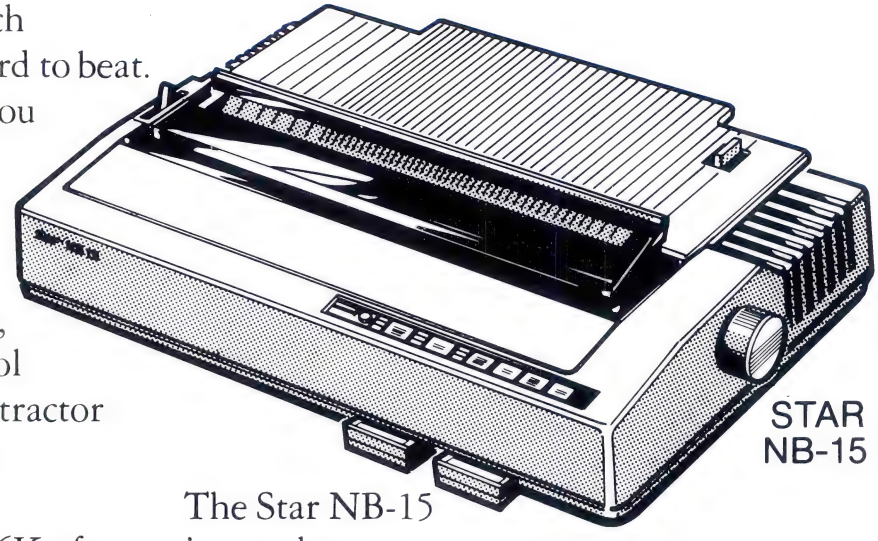

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GEOS

Following last month's Benchtest on the 64C, Kevin Bergin returns with a closer look at this new operating system for Commodore 64 owners and discovers its strengths and weaknesses.

GEOS (Graphic Environment Operating System) was developed for the 64, the 64C and the 128 by Berkeley Softworks. The concept of GEOS is to provide the target machine with an operating system which creates a menu driven environment. For the 64C and the 64, it also has a number of other advantages.

Features

The GEOS operating system, and its applications come on one floppy disk, which is heavily protected. A back-up disk can be made using the routine provided, but the back-up will not run and is only useful for restoring damaged files or disks. The manual states at length the importance of making at least one back-up disk for emergencies. One could question the validity of protecting an operating system and leaving the user at the mercy of the dreaded disk error, or stray cup of coffee on the floppy. I'd rather that the applications were protected and the GEOS kernel left unprotected.

Booting GEOS

Starting GEOS is simplicity itself: put the GEOS disk in the disk drive (you will of course need a disk drive to use GEOS) and enter LOAD "*",8,1, and GEOS informs you that it is installing itself. In 25 seconds the main menu appears and GEOS is active. About 34k of code has been loaded in these 25 seconds and all disk I/O is performed at the same rate from within GEOS. As a point of interest, the command LOAD "*",8,1 ("load into RAM saved from") can be given as LOAD "*",8,?, where ? is a number from 1 to 9. So to save time and finger movement LOAD "*",8,8 is the most convenient.

Back to the task at hand: the main menu in GEOS (the desktop) has a number of options. The desktop and all GEOS screens are displayed in high resolution and the displays are therefore very detailed. All text displays in GEOS are in 80 column mode rather than the large 40 column mode. The GEOS desktop is the tie between all GEOS programs.

At the top of the desktop screen is the command menu from which you can select any of the GEOS functions such as the note pad, the preferences, the calculator and the text manager. Printer and input drivers are also selected from the GEOS command menu. Next are the file options which include the ability to open one of the applications, duplicate a named file onto the same disk, rename a file, and print a file.

Selecting the view option from the command menu allows the user to display filenames on the current disk by icon, size, type or date. The disk option allows the user to open/close a disk, rename a disk and copy entire disks (not very fast with one drive), add a drive, validate a disk or format a disk (GEOS format).

The last item in the command menu is labelled 'special' and has three options: to return to Basic (for the moment), to reset GEOS (reload the Desk Top); or load Q-Link (a communications program on the reverse side of the disk). There are a number of gadgets (functions selected with the mouse or the joystick) available. Activating gadgets is achieved by using the mouse or joystick to position the pointer over the gadget and pressing the left button on the mouse or firing on the joystick (called clicking).

There is a close gadget positioned at the top right of the desktop, clicking once on this closes the current disk. A disk should be closed before exiting GEOS or inserting another disk. The disk notepad displays the files on the current disk. These appear initially as icons (graphic representations of the file), but can be viewed by size, type, date or name. Only eight icons can appear on the disk notepad, so the user can page through by clicking on the 'dog-ear' at the bottom left of the desktop.

Two other icons appear at the bottom right of the screen. These are the waste basket (some may know it as the 'trashcan') and the printer. The waste basket is used to delete files (if they are not locked). This is done by clicking once on the icon of the file to scrap, pausing and clicking again. A ghost image of the icon appends itself to the pointer. Dragging the ghost image over to the waste basket and clicking once will remove the file from the disk (it is not recoverable once it has been scrapped). The printer icon is used in a similar way. Text files can be sent directly to the printer by dragging them over to the printer icon and clicking.

Files under GEOS are grouped under a number of categories. System files include the GEOS loader, GEOS boot and GEOS kernal programs. Program files include GEOS applications, desktop accessories and user programs. Data files are documents created by GEOS applications, font files or non-GEOS data files. Drivers include input and printer interfaces. The last file category are non-GEOS files. These are displayed as C64 icons and cover any files not converted to GEOS format.

GEOS Drives

If you have one disk drive connected, GEOS always recognises this as drive A. Adding a second drive to GEOS can be done by setting the jumpers in the drive

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GEOS: dangerously Mac-like . . .

or in software from GEOS. When two drives are installed, GEOS recognises the drive configured as device 8 as drive A and the drive configured as device 9 as drive B. A two drive system makes the copying of files or disks much faster.

Basic from GEOS

As mentioned earlier, Basic can be entered from GEOS by selecting it from the special option on the command menu. After you have finished with Basic and wish to re-enter the desktop, simply press the restore key. This will reload the desktop. The restore key generates an NMI (Non Maskable Interrupt) and GEOS resets the NMI vector to point at location $C000. The code to reboot the desktop sits at $C000 to $C100, so that any programs that use this part of RAM will corrupt the reboot program and will disable the rebooting of the desktop.

Basic programs may be booted from the desktop in the same way as any other application. Just double click on the program icon to load and execute, so long as it is 26k or less in size. Any Basic program over 26k will be loaded and executed, but will revert to the normal disk routines and the sluggish old speed.

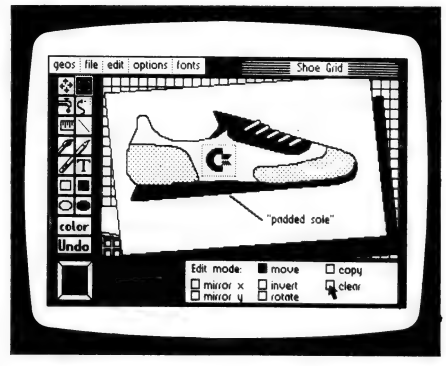
Berkeley Softworks claims that it will be publishing a reference manual for Basic and Assembly language programmers, which will give access to all of the GEOS routines via a jump table. Hopefully, it will describe in detail the routines and their usage. In any event it will mean that many existing user programs will need rewriting to operate under GEOS and take full use of the features GEOS offers.

Other features of GEOS are its applications, the preference manager, the drivers and the fonts. The preference manager is activated from the desktop or from another application. It allows the user to set the time and date (this is best done at the start of each session to keep track of creation and updates to files); the border, background, foreground and pointer colours can be changed; and the responsiveness of the joystick or mouse and the shape of the pointer can be edited to suit your tastes. All of the changes are saved onto disk so that each time you use GEOS your preference selections are activated.

The other support programs include a calculator, which can be used with keyboard, mouse or joystick. There is also the notepad (good for capturing those elusive ideas and saving them on disk) and the alarm clock which can be set to go at the time you think you will collapse with exhaustion over your 64. The text and photo managers allow the transfer of data between geoWrite and geoPaint. Remaining programs include a large selection of fonts for the user to select from and a reasonable number of printer drivers, covering some of the more popular printers. More printer drivers will be made available, including one for a laser printer (who would have imagined a laser printer hooked up to the 64?).

The Mouse

The input drive is still at present a bit of a curiosity. It is of course meant to select



Graphics demo under geoPaint

the means of input. But currently there is only a joystick driver, so this is the default input driver. For this review a 1350 mouse was supplied. With great expectations the mouse was hooked up only to discover there was no driver. Commodore claims that the joystick driver works for joystick, trackball and mouse. While one could say that Commodore is wrong (the mouse does work), it is sluggish in some operations and over sensitive in others. By setting the preferences correctly the mouse can be used, but the familiar joystick is faster and easier to control. A trackball was not tested, but would probably operate in the same way as this mouse.

Berkeley Softworks will be developing input drivers for third party vendor hardware. Perhaps a driver for the 1350 mouse would be a good idea.

. . . even pull-down menus!

Applications

There are two GEOS application programs, geoWrite and geoPaint. geoPaint is a graphic design program with many features which have by now become standard. The user can draw lines, outlined or solid circles and rectangles, and paint patterns with different brushes. Cut, copy and paste are there to assist the user to move areas of the design, and a zoom mode has been incorporated into the package so that the user can edit the design, pixel by pixel. The usual undo, erase and fill options have been included.

All of the tools in geoPaint are selected from the icons at the side of the screen, while the command is still along the top of the screen. There are tools which allow the user to produce the best possible hard copy from geoPaint. The first one allows the user to measure distances accurately in pixels or inches (scaled drawings). The other tool is a window which allows the user to move quickly around the design, while a smaller window shows the movement in relation to the whole document. These features are usually to be found on much larger and more expensive systems such as MacPaint on the Apple Macintosh and the performance of geoPaint is comparable to MacPaint.

In short, geoPaint offers the user a powerful graphics editor which can be used via the desktop with geoWrite and the desktop accessories, to form a powerful desktop publishing tool.

The word processor which comes bundled with GEOS, geoWrite, has some very powerful and impressive features. It is activated by selecting its icon from the desktop. The most attractive feature is without doubt the font selection. There are six fonts to select from and some of them can be selected with different point sizes (from the style option). GeoWrite will support any mixture of fonts in the same document. Other options include the ability to go to the previous page, next page, specified page, set page break, or hide picture. The cut, copy and

paste options are available as are the same file options found in geoPaint.

After eight years writing computer related articles with word processing packages, the next 'fantastic' package is still eagerly awaited. GeoWrite is not the one. It is not the fastest of word processors, although it could be said to be acceptable, and it is probably equal to the likes of Easyscript but not to 'Paperclip'. Perhaps the power of geoWrite lies in its interaction with geoPaint and the desktop accessories.

Both geoWrite and geoPaint could each warrant an article, but the information above should provide a good insight into their capabilities. The user guide which accompanies GEOS has good documentation on the applications and is generally an excellent user manual. However, there are few technical references, so we will all be waiting with bated breath for the reference manual.

GEOS speed and users

All operations under GEOS are faster than the standard 64 operations. Berkeley Softworks claims an increase by a factor of 10 on disk I/O under GEOS. This is certainly true and it is also faster than the popular fast loading cartridges.

GEOS uses its own routines to achieve fast loading and this is at the expense of user memory, to some extent. Writing programs with or for GEOS means that the programmer has to know the GEOS routines intimately and not use any memory that GEOS resides in, or that GEOS uses for data or pointers. However, the user gains some memory, as GEOS uses available space on the active disk for storage.

Using GEOS has the obvious benefit of speed and the added bonus of an easy to use mouse/joystick menu driven desktop system, plus the two powerful application programs. So for those 64 owners who use their 64s for word processing and design work, GEOS is a must. Schools will also benefit from GEOS as the Desktop is almost self explanatory. However, programmers may have some problems with it. Basic programmers will be limited by the size of their programs if they wish them to operate under GEOS and assembly language programmers will be limited by the areas of RAM they can use if they wish to use the GEOS functions.

'Berkeley Softworks will be publishing a reference manual which will give access to all of the GEOS routines.'

The GEOS kernel and Desktop appear to use a lot of the RAM from $0400 to $A000 for data and programs. Most of the kernel is in shadow RAM from $D000 to $FFFF. This is not much help to budding GEOS programmers, but a jump table can be found at $C100 to $C2C5. This will be useful, providing you can discover how to read it! In fact, the code from $C000 to $CFFF is of interest to programmers wishing to write their own routines to run under GEOS.

Conclusion

For around $80 GEOS is an unbeatable operating system for your 64. The advantages for a large section of 64 owners are the speed of the built-in accessories and the two application programs. It could well be that some 64 owners may never need or use anything other than GEOS on their 64s. To education it comes as a boon. It extends the life and usefulness of 64s already in use and gives pupils a cheap look at the now popular mouse driven desktop systems.

Programmers can make good use of the fast loader and then develop their programs with GEOS features by directly tapping into the GEOS routines. However programmers and hackers alike (yes, there is a difference) will suffer from lack of RAM and a lack of use for GEOS as a serious tool. Another constraint is the control GEOS takes of the 64 thereby restricting the programmer. It may be worth keeping in mind the assurances from Berkeley Softworks that it will make available technical information on GEOS, particularly to software houses (not reviewers it seems), in order to encourage software development under GEOS.

Finally, the protection scheme leaves a lot to be desired. Users should be entitled to make working copies of their operating system.

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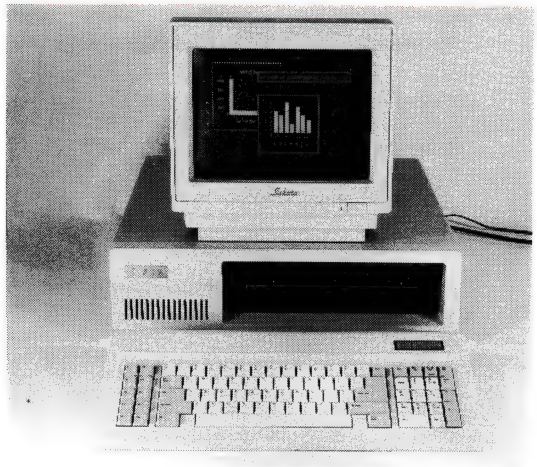

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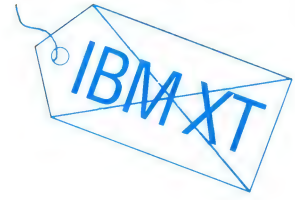

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Right and wrong

One of the fundamental human learning processes is the distinction between right and wrong, but can this technique be applied to computer programs? In the second part of his series, David Levy presents decision-making of the digital kind.

The learning process in man is one of simple reinforcement. If you get something right, you remember that the method led to success, and the next time you can do it the same way. If you get something wrong, you will try a different approach the next time you are faced with the same situation. Computer programs can be made to learn using the same fundamental approach — reinforce successful decisions and reduce the likelihood of repeating unsuccessful ones.

To see how this concept works in its simplest form, let's consider a problem situation in which there are two possible decisions. Starting with absolutely no information about the problem, how does man, or a computer program, learn the best decision to make in this situation?

Situation	
Decision 1	Decision 2
Result 1	Result 2

A simple way to think of the learning process is to imagine a decision-making situation being represented by a box. In the box, there is a demon who makes the decision whenever that particular situation is encountered. Let's assume that the first time the demon encounters the problem situation, he has absolutely no information on which to base his decision. He could indicate this by attaching the value 0 to Result 1 and Result 2. He then tries a decision at random (say, Decision 1) and discovers that Result 1 is a failure. He can indicate this by changing the value associated with Result 1 from 0 (meaning no information available) to −1 (which is used to indicate failure).

The next time that the demon is faced with the same situation, he examines the values associated with each decision and sees that one of them, the −1 associated with Decision 1, indicates failure, whereas the other value (which is still 0) indicates that no information is available concerning the merit of Decision 2. As the demon always attempts to avoid failure, he tries Decision 2, and is pleased to discover that Result 2 is a success. Accordingly, he assigns the value +1 to Result 2 (+1 is used to indicate success).

From now on, the demon will never have any difficulty when faced with the same problem situation — he will simply examine the values associated with each decision and make the choice that has associated with it the indication of success — a value of +1.

Complex environments

When the decision-making environment is more complex, the method of learning the best decision also becomes more complex, but the underlying philosophy remains very similar. In a simple environment it is possible to attribute success or failure directly to one decision, and to know that a certain decision will definitely produce success while another decision will certainly result in failure. The principal difference in a more complex environment is that most of the decisions are merely way points on a (possibly long) decision-making path, and it may not always be possible to determine that success or failure is directly attributable to one or more specific decisions.

In order to help the demon make his decision in a more complex environment, the decision box may be thought of as containing a number of balls, each of which is labelled to represent a particular decision that can be made in this situation. When the demon is required to make a decision, he selects a ball at random and examines the decision label on that ball. The decision on this label is enacted, and a note is made of which decision it is. If the result of the whole decision-making process is eventually found to be satisfactory, another ball is added to this particular box with the same decision label as the one just examined. The next time a ball is chosen at random from the box, it will be more likely that the same decision will be made.

If, on the other hand, the first random selection is a decision which eventually results in failure, a ball with that decision label is removed from the box. The next time the same situation is encountered, it will be less likely that the same decision will be made.

You can probably see that this method is merely a more sophisticated exposition of the aforementioned value method. Instead of starting with the 'unknown' values of 0 for Decision 1 and Decision 2, we could start with a box containing one Decision 1 and Decision 2 ball. When the Decision 1 ball is chosen at random and results in failure, it is removed from the box. The next time that the same problem situation arises, the box will be found to contain only a Decision 2 ball. When Decision 2 is made and leads to success, another ball labelled Decision 2 is added to the box; and on every subsequent occasion that a ball is taken at random from this box, it will have a Decision 2 label, so in future Decision 2 will always be made.

The boxes method is unnecessarily cumbersome for situations in which success or failure can be directly attributed to a specific decision, but it is useful when a particular decision-making situation is only one stage in solving a problem. One of the first problems on which the boxes method was tried was the game of noughts and crosses, in which every possible game configuration is represented by a different box (Fig 1).

In the original boxes experiment which was conducted at Scotland's University of Edinburgh in 1961, 288 matchboxes were used to represent the 288 different situations that can arise in a game of noughts and crosses. Each of these boxes works as an independent learning device, which is used only when the

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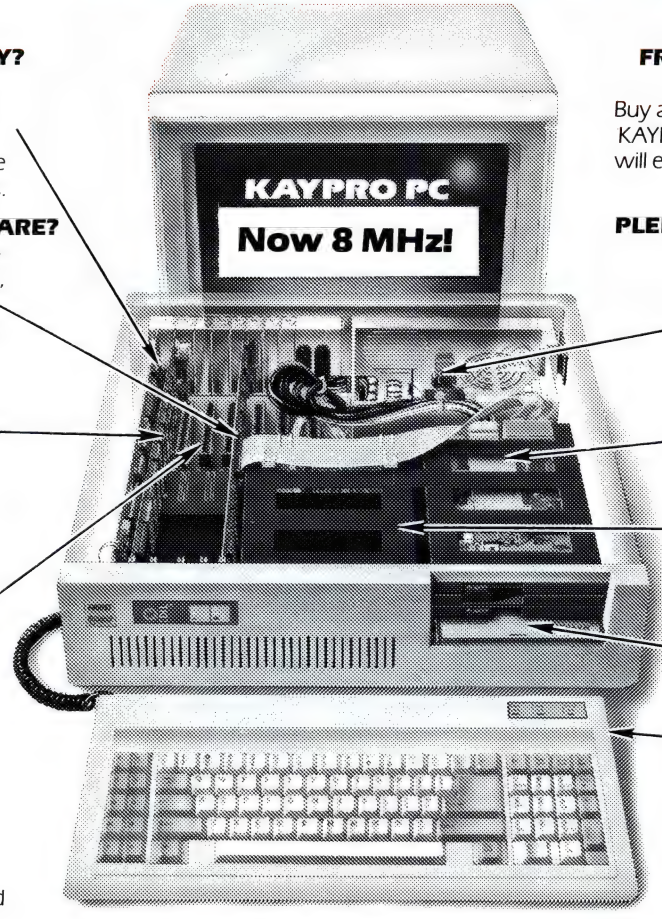

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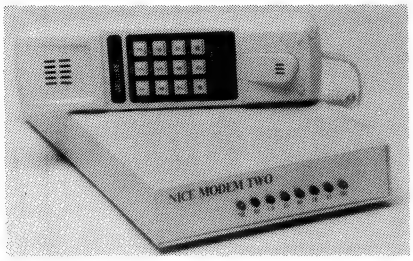

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particular situation represented by that box arises in a game. At the start of the experiment, a number of beads of different colours are put into each of the boxes, each colour representing a different (vacant) space in the noughts and crosses diagram. The whole system of boxes can be thought of as representing a computer program, and the number of beads of each colour in a box corresponds to the program instructions which determine what move is made in the situation represented by that box.

When a particular configuration arises in a game, the program examines the box representing this situation and counts the number of beads of each colour in the box. For example, at the start of the game (Box 1), there might be 100 red beads meaning play in the centre; 100 blue beads meaning play in a corner; and 100 green beads meaning play in the middle of an edge. The program picks a bead at random, and if it is a red bead, the program makes the corresponding move in the centre of the diagram. The program then remembers which colour bead it picked and proceeds to the next situation (and hence the next box) after its opponent has replied to its first move.

At the end of the game, if the boxes program has won, it assumes that all its decisions made during the game were satisfactory and, therefore, reinforces every decision. In this case, part of the reinforcement process would consist of adding another red bead to Box 1. Box 1 would then contain 101 red beads, 100 green ones and 100 blue ones, so that the next time the program has to make the first move in a game, it will be slightly more likely to pick a red bead than a blue one or a green one. If the boxes program has lost the game it would remove one red bead from Box 1, thereby reducing the likelihood of making the same move next time it starts a game. And if the game has been drawn, the program would leave the contents of Box 1 unchanged. In practice, after conducting

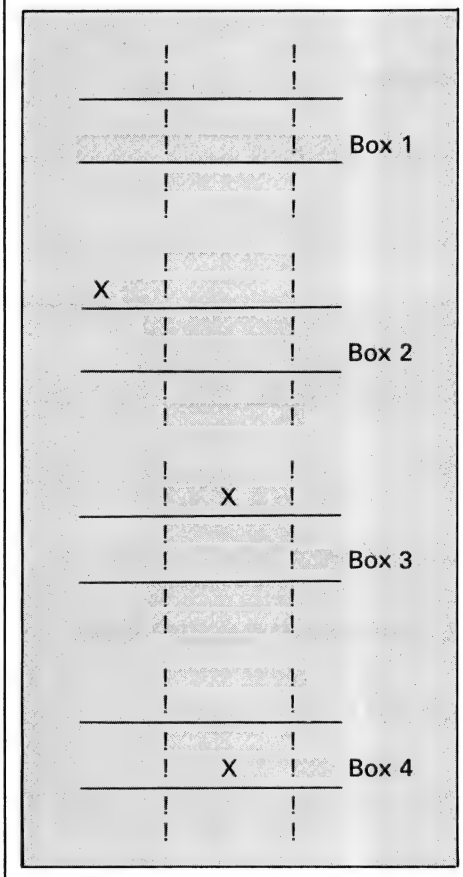

Fig 1 The boxes experiment

Number of games played	Score
100	10
200	54
300	63
400	58
500	75
600	70
700	68
800	72
900	76
1000	70

Fig 2 System performance

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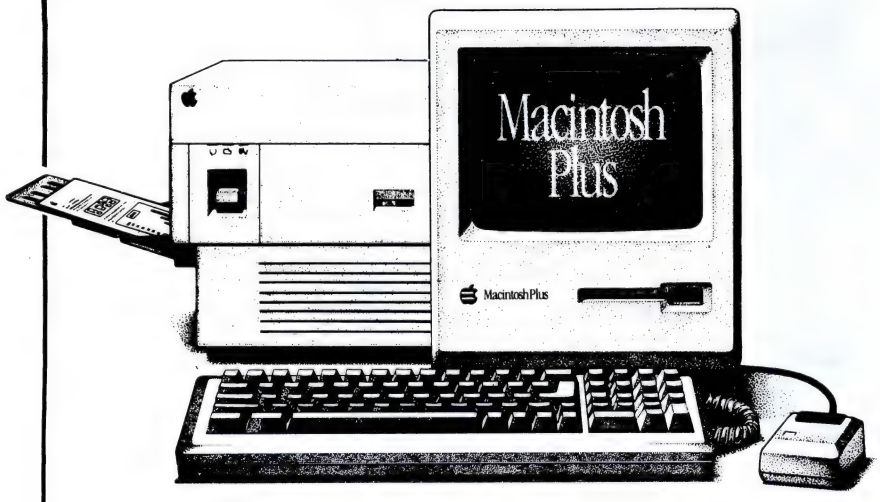

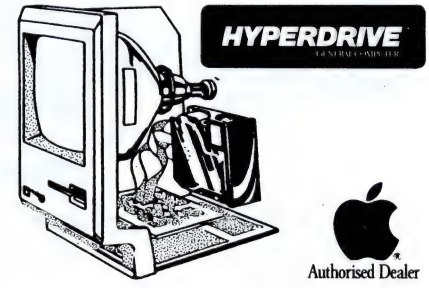

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a large number of experimental trials with this system, you would expect to find a very high proportion of red beads in Box 1.

The same procedure is followed for every box encountered during a game, and as more and more games are played with this program, the whole system becomes more and more accurate. Fig 2 shows how the performance of the system improves with experience. The results are taken from a series of games played against an opponent which always moved first and which always played entirely at random. The score column shows the number (of wins — losses) scored by the boxes system.

It has been calculated that with the best play, it is possible to achieve a score of 87 (wins — losses) over a series of 1000 games against a randomly moving opponent who always plays first. The boxes program fails to reach this optimal result because it tends to gain a lot of knowledge about how to play in some situations (the ones that it encounters frequently), but very little or no knowledge about how to play in others. In order to learn to play an absolutely optimal game all the time, the program would need to play bad moves deliberately from time to time in order to gain a lot of experience with every single box in the system. (This phenomenon is rather similar to the classic problem of how to reach the highest peak in a range of hills. The obvious thing to do at any stage is to move upwards, but in doing so you might merely be moving towards a 'local' peak rather than the 'global' one which is the target of the exercise. The only way to know that you have found the highest peak is to explore the whole region). Nevertheless, the performance of the boxes program is reasonably impressive for such a simple system, and the technique can easily be adapted to many other types of problems.

Improving the method

The 'boxes' method described above gives an equal amount of reinforcement to every decision made on a path to success, but in most problem-solving environments this will not truly reflect the relative merits of the various successful decisions. Let's consider the game of noughts and crosses as in Fig 3.

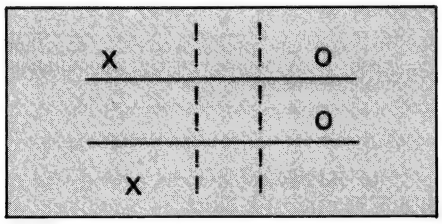


Fig 3 Noughts and crosses

X is to move next, and we can see that X can win at once by playing in the middle of the left-hand edge. But X can also win by playing in the bottom right-hand corner, though in this case victory will be postponed for one move. Using the simple boxes approach, each of these moves would, after the end of the game, result in a one-bead reinforcement to every box on the success path.

In most problems, it is of at least some importance to succeed (or win) as quickly as possible, and for this reason it is logical to give greater reinforcement to those decisions which are on the shortest success paths. We can modify the boxes method in the case of noughts and crosses so that the number of beads of reinforcement added to 'successful' decision boxes is related to the number of moves required to win the game — the quicker the win, the more reinforcement is given. In the above example, when four moves by X are required for victory, this modified boxes method might result in the moves 'top-left', 'bottom-left' and 'bottom-right', each having a reinforcement of, say, two beads, as would the fourth and final move by X. But when only three moves by X are needed for victory (top-left, bottom-left and middle-left), each of these moves could be reinforced by adding three beads to the appropriate box. This modified strategy will result in the example shown above preferring the move which leads to immediate victory to the one which leads to a slower victory.

Another refinement would be to reinforce decisions on a success path by a number which is inversely related to the number of moves required, from that point in the game, to force a win. This would bias the success and failure reinforcements more heavily near the end of the game than near the start, and would speed up the learning process.

Scoring functions

It is well-known in chess, draughts and many other board games that the most important feature is 'material' — that is, the pieces themselves. The player with an advantage in material usually wins the game, other things being equal. We could, therefore, say that the best move in a chess position is the one which leads to the gain of the largest amount of material, the second best move is the one which leads to the gain of the second largest amount of material, and so on.

It is usually the case in chess that no move can be seen to *guarantee* the win of material, and so other factors come into consideration. The next most significant feature in chess, after material, is mobility — the total freedom of movement of the pieces. This is often measured by counting the number of squares which each piece attacks, and adding the totals. We can then say that if two or more moves lead to the gain of the same amount of material, the move to be chosen is the one which brings about the greatest possible increase in mobility. By introducing knowledge about other aspects of chess, such as centre control, king attack, pawn structure, and so on, it's possible to create a decision maker which combines information about how many of the various features are present in a position with a knowledge of the relative importance of each feature. This decision maker is known as a scoring function (sometimes called an evaluation function).

To see how a simple scoring function is derived and works, let's consider the problem of the commuter who has a choice of two ways to get to work. He may travel by bus for five kilometres to the nearest station and then by train for 20 kilometres; or he may travel by bus for eight kilometres to a station on another line, and then by train for 15 kilometres. The bus moves at 10km and the train runs at 60km. Which is the fastest way to get to work?

We can represent this problem by means of a simple scoring function (Fig 4). It isn't difficult to see that the score

$$\text{Score} = \frac{\text{bus kilometres}}{10} + \frac{\text{train kilometres}}{60}$$

Fig 4 A simple scoring function

represents the number of hours taken to complete the journey, and that the journey with the lower score is the faster. In this example, the features of the scoring function are bus kilometres and train kilometres; the amount present of each feature is the number of bus kilometres in the journey and the number of train kilometres; and the relative importance of these two features is 1/10 to 1/60.

In any kind of problem solving environment, a computer program needs to know which features are sufficiently relevant to be incorporated in the scoring function, and it must also be able to measure how much of each feature is present; all this information is supplied by *homo sapiens*. But although most programs are also provided (by humans) with the relative importance (or 'weighting') for each of the features in the scoring function, it is possible for a program to learn to improve its own

weightings or even to learn them from scratch.

One way in which this can be achieved is the use of multiple regression analysis, a well-known method in statistics. What multiple regression can do for us is to consider a number of decisions made by human experts and use this information to determine how much importance the human experts give to the various features in the scoring function. In the case of chess, for example, a program could observe how a Grandmaster acts in a number of different positions.

Let's assume that a chess program can measure six features in a chess position: material, mobility, king safety, pawn structure, centre control and king attack, and that asociated with each feature is a numerical weighting which has been designed to represent the relative importance of the features to each other. We'll refer to these weightings as Wma, Wmo, Wks, Wps, Wcc and Wka respectively. The merit score for any chess position can then be calculated from:

(Wma × material) +
(Wmo × mobility) +
(Wks × king safety) +
(Wps × pawn structure) +
(Wcc × centre control) +
(Wka × king attack)

When faced with a choice of moves in a chess position, a program could use this 'scoring function' to compute a score for every single position that could arise after making its next move, and it could then select the move leading to the position with the highest score.

In order to arrive at the best possible set of values for the weightings Wma, Wmom and so on, the program could consider the moves made by a strong human player and assume that his moves will always be better than the alternatives available. Just one assumption of this type can provide a whole wealth of useful information. For example, if the program sees a human chess master opening with the move e2-e4, it might assume that e2-e4 is better than all other moves available. It then produces a set of inequalities such as:

score after e2-e4 > score after a2-a3
score after e2-e4 > score after a2-a4
score after e2-e4 > score after b2-b3,
and so on,

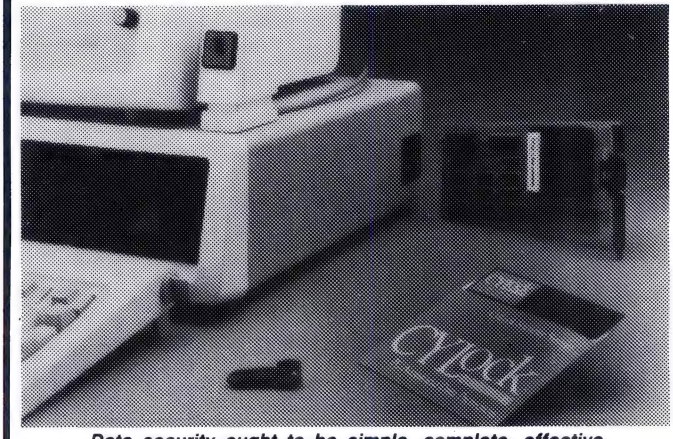
where 'b' means 'is greater than'.

Each time the strong human player makes a move, the program acquires another set of inequalities, and each set of inequalities allows the program to increase the accuracy of the various weightings. (There are standard methods for solving large numbers of inequalities). The program is simply observing the actions of the human expert and then trying to modify its own play to be as close as possible to that of its 'teacher'. The result would be that the weightings of the features in the program's scoring function would approach some 'local' optimum — local in the sense that the weightings would be optimal for the set of positions that have been used for the regression analysis.

Computer learning

Up to now we have considered how computer programs might learn in a static environment such as a game of chess or noughts and crosses, where the laws of nature (the rules of the game) are constant. However, there are many real life situations in which the laws of nature change, and an intelligent program should be able to monitor such changes and learn how to adjust to them.

A relatively simple example is a program designed to predict how far a



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ship will travel in the next 24 hours, assuming that no weather forecast is available. The program might make an assumption about the weather based on some kind of average during the previous 10 days, but it should place more weight on the weather for the current day than it does on the weather 10 days ago. It might assume, for example, that the wind speed tomorrow will be as shown in Fig 5.

$$\frac{(\text{wind speed today} \times 4) + (\text{average wind speed for past 10 days})}{5}$$

Fig 5 Calculating wind speed

This formula gives four times as much weight to recent information as it does to older information, and hence is rather susceptible to recent changes in the environment.

Another more complex example is the following problem. Assume that we have a chess playing program whose task it is to learn how to play in the style of its human opponent. It learns to optimise its scoring function in exactly the manner described above, but instead of considering every set of inequalities as being of equal importance, it gives, say, three times as much weight to the inequalities provided by its present opponent as it does to those of the past. In this way, the program's learning process does benefit from all its past experience at the game, but its 'style' will quickly come to resemble that of its present opponent. If its present opponent likes to advance on the wings, the program will soon find its scoring function modified to give more emphasis to the wings (and, therefore, less to centre control). If its present opponent enjoys sacrificing his pieces, the program will quickly learn that material is not quite as important as it originally assumed, and it too will begin to make sacrifices.

Similar learning techniques have been used to teach a computer program how its opponents at the poker table change the style and the frequency of their bluffing, and a friend of mine who is a professional poker player even lost 'money' to such a program during a rather long session.

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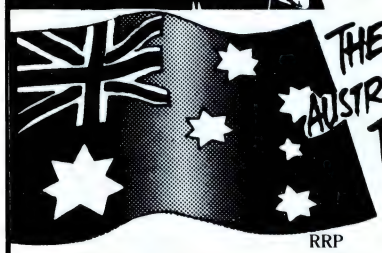

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SCREENTEST

Rbase 5000

Rbase 5000 from Microsoft is an attempt to steal the data management crown from the dBase family. But is the package complete enough to succeed? Kathy Lang finds out.

In the market for database management systems providing a full range of capabilities on micros, the dBase range from Ashton-Tate has led the market for as long as there have been micros powerful enough to support sizeable databases. Even on the IBM PC, where the widest choice of such packages is to be found, dBase II, III and III Plus between them are said to have about 15 per cent of the total packages software market, outselling their nearest rivals five times over. Small wonder, then, that many other suppliers look hungrily at dBase's position, and the most ambitious set out to take the dBase family head-on. The latest supplier to do this is already one of the giants of the micro software world, though with a stronger track record in languages than in packages: Microsoft, which has acquired the Rbase database management system from US software house Microrim, and which is now aggressively marketing the latest version, Rbase 5000, in Australia.

The basic set of information handled by Rbase 5000 is a table; each table is stored in a file, and indeed an Rbase table corresponds to a file in other packages with each row in the table being a record and each column a field. A set of tables (nominally 40, but in practice 37) comprises a database. Connections between tables are made during processing, rather than being permanently established when the database is set up initially. Instructions can be given to Rbase 5000 in a number of ways: through commands entered at the keyboard (with prompting if desired); via sets of stored commands; or through complete applications including menus and tailored Help screens. Once set up, command files or complete applications can be compiled, to speed processing and to protect code from change by inexpert users. Applications can be set up directly using an editor — Rbase 5000 has its own, but you can use any suitable program — or with plenty of help by using Rbase 5000's Express facility. However, the limitations in Express suggest that, while it would be useful as a learning tool, most system developers will need to use the command system direct.

Thus far, you can see that Rbase 5000 has the basic features to enable it to compete with dBaseIII Plus and with other powerful database systems such as Dataflex, at least in the single-user market. Now to explore these features in more detail.

Constraints

The main limitations and features of Rbase 5000 are shown in Fig 1. None of the constraints should cause problems except, in some applications, the limit of six digits on computational accuracy with real numbers. An important point to note, though, is that while any single table may have up to 400 fields, the same limit applies to the total number of fields in a whole database. An important omission is the absence of an Array data type: few data management systems have this, but it's very useful for system developers. As with dBase, you can simulate lists to some extent by using memory variables with appropriate names. No limit on the number of memory variables is specified.

File creation & indexing

File definition in Rbase 5000 is entirely separate from the specification of screen layout through user-designed forms. The essential requirement is to define the contents of each table in a database, by specifying the name, type and length of each field. This can be accomplished either through the Express application, which gives some prompting and allows screen editing of entries, or by entering keyboad commands directly. That process is more tedious and less easily modified than using Express, so for this purpose I suspect everyone will use Express. Unfortunately, you cannot specify in Express which fields are to be used as keys, so even the most inexperienced user must learn something of the command language right away.

There is no restriction on the number of indexes, but each must consist of one complete field — no subfields or linked fields are allowed. Indexes are used only to speed retrieval of records, not for ordering purposes; to see records in a particular order, they must be sorted each time that requirement arises. And from my Benchmarks, it appears that the speed of sorting is unrelated to whether or not a field is indexed. Indexes are, however, kept up-to-date automatically, and you don't need to specify the indexes when a file is opened.

The relationships among tables in a database are not defined when the

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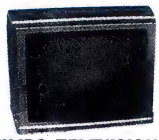

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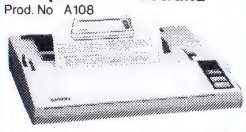

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Maximum file size	Operating system limit
Maximum no fields	400
Maximum digits	16
Link to ASCII files?	Yes, can vary formats
Fixed rec structure?	Yes
Amend rec structure?	Yes
Link data files?	Yes
No sort fields	10
Maximum key length (chars, fields)	1500, 1
Data validation	Good
Unique keys	Optional
Store calculated data	On input, or updating in batch; batch process to change specified fields/ records
Store selection criteria	Permitted
>1 criterion/field?	Yes
Browsing methods	Any field for viewing or editing
Reference manual	**
Reference card	****
Hot-line?	Depends on dealer
Max record size (chars)	1530
Max field size	1500
Max prime key length	1500
File size fixed?	No
Data types	Numeric, integer, character, date, money format
Fixed record length stored?	Yes
No data files open	37
No keys	Unlimited
Subsidiary indexes	Kept up-to-date automatically
Screen formatting	Paint-a-screen, default format supplied
Report formatting	Paint-a-screen, special link to WP for output
Totals & statistics	Yes
Combining criteria	AND, OR, NOT
Wild-code selection?	Field may contain specified character(s)
Interaction methods	commands, full tailoring
Tutorial guide	**
Online Help	***

Fig 1 Features and constraints

database is created; rather, they are *ad hoc* in the sense that you can request reports on data from several files, and set up screen forms which enter data into several forms, but you cannot define relationships as being intrinsic to the database itself.

Data entry & updating

A variety of methods of data entry are provided in Rbase 5000. The most basic is to use the LOAD command, which allows you to enter data one field at a time; field names are provided as prompts on request. Editing is available only within the entry line. You would therefore be most unlikely to use this mode except for occasional additions to tables with very few fields. The usual method is to set up a screen form, using 'paint-a-screen' methods, to enter data, usually into a single form (though a form can enter data into several tables if necessary). A screen form can have calculated fields as well as those entered from the keyboard.

Larger sets of records can be added to tables by using the APPEND command to tack one table onto the end of another; in addition, the usual range of relational operations such as JOIN and INTERSECT are provided to merge two tables in a controlled way.

Data editing can be accomplished through screen forms, again applying to one table or several, or using a one-record-per-screen-line browse. In either case, data is selected for editing by attaching a 'WHERE' clause to the EDIT command when using the direct command mode rather than editing through a tailored application. This approach requires a little more forethought — or more typing, or both — than the more conventional approach of entering a key field value in a model record on the screen. It can also be more flexible than the usual method, since it means that any subset of records can be selected for editing, and sorted in any order, according to decisions made when the editing takes place.

Rbase 5000 can validate data against a set of rules. These rules are flexible enough to provide for most requirements: for example, you could specify that a field value must already exist in another table (say, to validate customer numbers on invoices), or that it must not exist in the current table (to ensure unique customer codes). The rules are set up with direct commands rather than through Express, and the process is rather tedious (though it does help to use a proper editor to enter them into a command file). When data is being entered interactively, Rbase 5000 will not allow the user to enter an invalid value, and will display the message specified in the rule when an error occurs. For batch updating, an exception file is created of amendments that do not conform to the rules.

Groups of records, or a complete table, can be updated automatically; amendments allowed include calculations on existing fields and/or constants, so you can carry out operations such as increasing the price of all products in a particular group by 10 per cent.

The way these features have been implemented provides evidence of the uneven development of the package — more on this under 'In use'.

Screen display

Rbase 5000 provides two main types of screen display: the list format used in editing and viewing when no customised screen is invoked; and user-built screen forms. The list format allows selection of columns and control over their widths.

BM1	Time to add one new record	Inst
BM2	Time to select record by primary key	Inst
BM3	Time to select record by secondary key	5secs+
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	13secs+
BM5	Time to access record using wild-code	23secs+
BM6	Time to index 1000 records on three-character field	56secs
BM7	Time to sort 1000 records on five-character field	25secs
BM8	Time to calculate on one field per record and store result in record	34secs
BM9	Time to total three fields over 1000 records	39secs
BM10	Time to add one new field to each of 1000 records	4mins 5secs

Time to import a file of 1000 records: 7mins 8secs

Notes: NT = Not tested. NP = Not Possible. + = including scrolling. Where two times are given, first is access to first record, second is access to each subsequent record

Fig 2 Benchmark times recorded on an IBM PC/XT/H

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Paradox	1095	Table-based system for IBM PC, many similarities to 1-2-3. Tables can be related. Good querying and reporting, powerful command language. Keeps data in memory if possible: speed on larger tables should be checked. Easy to use at basic, menu-driven level.
Power-base	795	Powerful database management system with linking of many files, batch updating, up-to-date indexes, reporting adequate (no letter-writer), excellent links with other packages, for example, 1-2-3. No system development tools. Easy to use, documentation excellent.
Rbase 5000	1195	Powerful IBM PC package for system developers, command-based with compiler but no run-time system. Good data-handling and reporting from multiple (up to 40) files. Currently only single-user. User image and documentation rather confusing.

Fig 3 Comparison of similar data management packages

There are two types of screen form. When entering Rbase 5000 commands one by one from the keyboard, you are restricted to forms that access only one table, and are restricted to one screen. When using a full tailored application, or executing a single set of commands from a file, you can include forms that span several screens, and incorporate fields from more than one table. Finally, any report can be displayed on the screen as an alternative to printing.

Reports

Reporting facilities in Rbase 5000 are powerful and not too difficult to use; reports are set up using a paint-a-screen approach, with scrolling to allow the definition of wide reports. Calculated fields, headers and footers, subtotals, control over page width and the ability to transmit control codes to the printer are all provided. Reports can include fields from more than one table, and selection and sorting of records from the main or driving table is allowed. Fields may be longer than the columns defined to display them, and Rbase 5000 will wordwrap such fields when necessary. It would also be possible to construct simple standard letters using the reporting features.

Selection & sorting

Rbase 5000 provides a SELECT command that allows you to display chosen sets of records, either complete or specified fields only, one line per record on the screen. Many other commands allow you to select records by attaching a WHERE clause. A range of conditions is provided, using the usual relational operators such as greater than, not equal, and so on, plus wild-codes for single characters and strings to match text fields. Multiple conditions may be combined with AND and OR, but you cannot use brackets to alter the order of evaluation, so care would be needed with complex conditions. Selective retrieval is faster for indexed fields, provided that the last condition in the WHERE clause is testing an indexed field for equality with a constant, and that if the clause has more than one condition, these are combined with AND.

Selected sets of records, or a complete table, may be sorted by up to 10 fields before display. However, since this ordering is achieved by sorting, it is not maintained when field values change. To view or edit files in a particular order always incurs a time penalty. Where files are always kept in order, the cost is a very small addition to the time spent on saving each record. For packages such as Rbase 5000, the overhead is the time to sort the whole file, incurred each time the file is to be edited or viewed in order. And it may well be that the total overhead time may be less when using the Rbase 5000 approach (though that is very application-dependent). But my own view is that the small amount of extra time per record taken with the first approach is barely noticeable, whereas the time taken to sort a whole file, even in Rbase 5000 where the sorting is relatively efficient, is very noticeable indeed. You will have to judge for yourself whether this factor is worth serious consideration, since its importance varies a great deal between applications.

Calculation

You can include calculated fields on input forms and in reports. Rbase 5000 does not support a wide range of functions; for example, you can carry out a substring operation on a memory

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Systems:	PC
Features:	Database consists of tables (up to 37 in practice), related to each other when processed. Powerful data handling including data validation, selection and sorting onscreen, good reporting, programming-like language to create processing files and menus
Drawbacks:	Retrieval of single records via commands clumsy. Sorted order not maintained through edits. Max 400 fields per database
Ease of use:	Command language rather confused and inconsistent, not really suitable for novices. Documentation has some faults

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variable, but not directly on a field in a table, and there are no equivalents of functions such as finding the starting position of a character, nor any statistical functions on individual fields. You can, however, calculate sums, averages, counts, and so on, of sets of records or complete tables. You can also total fields included in a SELECT command.

Multiple files

Rbase 5000 allows you to have up to 40 tables in a database; three of these are used for housekeeping purposes, leaving a maximum of 37 data files. Linkage between records in screens and reports is achieved by matching appropriate fields dynamically, when the record linkage is required. Opinions vary about the merits of leaving such relationships entirely dynamic — flexible, say the proponents; anarchic and leading to corrupt data, say the critics. There is much to be said for the compromise approach, used in packages like dBaseIII Plus, of allowing you to specify permanent links if you wish, or to go for purely temporary links if that's more appropriate. However, Rbase 5000's generosity in permitting so many open data files will render such nice points irrelevant to many. (In practice, the overall limit of 400 fields in a database is likely to be reached long before the table limit).

Housekeeping & security

A range of housekeeping facilities is provided, including the ability to set up and change directories within Rbase 5000. You cannot, though, format a floppy disk from within the package. Security is handled by providing three levels of password that may be attached to any database: these allow the user to alter the database structure, to amend data but not structure, or to view data only.

Tailoring

Rbase 5000 provides a wide range of tailoring facilities, ranging from simply storing sets of commands in a file, to producing complete applications compiled for fast execution. Applications, which comprise command files for processing, menu files for directing control among sets of commands, and screen files to contain messages and help, can be built through Express or directly using Rbase 5000 at the command level and an editor. Express has limitations — the most severe being a maximum of 40 fields in the database and one selection condition in any WHERE clause — which I suspect will make it more interesting as a training vehicle than as a serious development tool. In most cases, then, you will need to develop your own command files, either as a supplement to Express or as complete files or applications. Command files can be created with RBEDIT, Rbase 5000's own editor, which provides screen editing features, or by using any editor which can produce ASCII text files.

In addition to the commands that can be entered from the keyboard, Rbase 5000 provides a good range of programming features such as conditional statements and loops, and the ability to define memory variables limited only by the available memory. There does not seem to be any way to save the values of memory variables independently of command files. Nor does there appear to be any facility for executing DOS commands from within the program (as distinct from running Rbase 5000 through a BAT file that can execute several programs in turn). This would provide a real limit on the usefulness of Rbase 5000 in building complex applications. The absence of a run-time system makes Rbase 5000 expensive for packaged applications.

User image

Instructions to Rbase 5000 can be given directly from the keyboard, using commands which are entered directly, or, if you prefer, in response to prompts. Commands can be stored in files, and command files can be used alongside menus and prompt screens in complete applications. Clearly such applications can be used by novices without computing experience, but I suspect that, even with prompting, Rbase 5000 would otherwise be quite hard going for novices. And while commands and options can be abbreviated, the command system is still relatively verbose.

There seems to be all sorts of inconsistencies, and plenty of evidence of the uneven development of the package. Some areas are highly consistent; others are quite a muddle. For example, you may want to update a group of fields automatically. If you want to assign a constant or a memory variable to a field in all or a selected group of records, you use the CHANGE command. To assign an expression, perhaps consisting of incrementing a field by 10 per cent, you use the ASSIGN command. And if you just want to change the value of one field to that of

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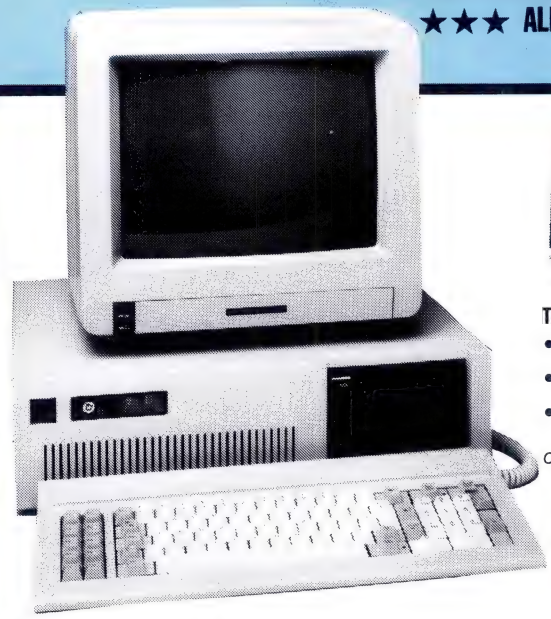

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another in the same record, you have to pretend that the assignment clause is an expression, entering a statement such as 'field1 Rbase5000field2+0'!

Documentation

The curiosities of some parts of Rbase 5000's user image are certainly not made any easier by the documentation. This consists of two manuals: a *User Guide* and a *Reference Manual.* The *User Guide* comprises a tutorial section, followed by a series of chapters on the fundamentals of the package. It includes a good explanation of the fundamentals of database design, but makes little attempt to relate this material to the structure of Rbase 5000 itself. (Indeed, I suspect that the conceptual and practical sections of the manual were written by different people.) The lack of any attempt to discuss the overall Rbase 5000 approach to data storage and handling makes the package very difficult to get to grips with. The problem is exacerbated by the way the tutorial section zips about between use of direct individual commands and of the Express module without explanation.

These confusions are partly the result of bad documentation, but in part also stem from the confusions in user image design.

The *Reference Manual* is sub-titled a command dictionary, which is a more accurate description since much of the nitty-gritty detail needed is not described there but in the *User Guide.*

Conclusion

Rbase 5000 is a powerful and sophisticated package, with most of the tools needed to build complex applications, though its facilities may well prove too difficult for novices to use. The ability to compile complete systems will be a powerful recommendation for many developers. Against the functional advantages must be set the haphazard user image, often unhelpful documentation, and absence of some useful features such as the ability to run DOS commands from within the package.

On price, Rbase 5000 is competitive for single systems at $1195. But there are no plans for a run-time system, so system developers have to pay for a full version for each user. A version to provide shared use on networks is expected in the near future.

Rbase 5000 is a strong contender in the market for database management systems on micros, but it may not be quite the world-beater its suppliers are hoping for.

END

New release

Just as we were going to press, Microsoft in the U.S. announced a shiny new version of Rbase, rumoured to be packed full of new features.

While the Australian office was reluctant to talk about the new version before it actually hit the streets, we nevertheless managed to glean a few snippets of vital information.

By the sound of it, the new Rbase (to be called Rbase System) is to Rbase 5000 as dBase III Plus is to dBase III. And, just in case that doesn't say it all:

Rbase System includes many of the features which were added to dBase III to turn it into dBase III Plus. RBase System breaks the single-user bottle neck through the support of LANs, initially 3-Com, PC-network and Novelle with possibly the IBM token ring coming along later. Essentially, RBase supports the MS-net standard, and so should run with (or eventually support) any networks which conform to that standard (market pressures aside). Although it's the very same software which runs in both single and multi-user modes, stepping up into multi-user requires that DOS 3.1 be loaded, in order to pick up the new NETBios.

Additionally, RBase has also expanded the 'Express' concept, now providing 'Reports Express', 'Forms Express' and 'Definition Express', all of which present a user-friendly front-end for the novice. Doubtless the command language will still be the place for anything ambitious, just as it is in dBase III Plus.

User views are now supported, which means that up to five tables can be relationally joined together and presented as though they were really a single table. This can be a very handy facility when building a system for someone who wants to make his own queries using the Express menus, but doesn't want to know about the relational file structures underneath. While details of this feature are sketchy, it's reasonable to expect all the usual features including field and record selection.

The command language itself remains pretty much the same, but, as Ashton-Tate did some time ago with dBase, it has been 'filled out' with what Microsoft calls 'Super-Math'. Strange name, but it's really a collection of useful functions for trigonometry, string manipulation and financial transforms such as net present value: all those things that it's very frustrating to be without.

Additionally, MS-DOS commands can now be issued within Rbase through the 'ZIP' command. This will presumably also allow other software products to be run within RBase — a very handy feature for any complex system builder. The ability to control colour within command files has been enhanced, and some sort of multi-diskette backup and restore facility for databases has been added, although why this is better than the standard MS-DOS commands, is really not too clear.

Bridging the gap between menus for the novice and command files for the expert comes a 'macro' style feature. This allows series of keystrokes to be captured and replayed at a later date, thereby allowing 'point and press' users the luxury of making their own regular reports. The Gateway facility now allows data to be both imported and exported.

Perhaps most importantly of all, many of the Rbase 5000 limitations have been lifted. The maximum number of tables per database is now 80 (77 in practice), and the maximum number of columns (fields) per database is 800. Moreover, the maximum record size has been raised to 4096 bytes and a double precision floating point data type has been provided which maintains accuracy up to 10^{307}. Additionally, a completely new data type for free text has been added, called 'Note' fields. At the time of writing, no details were available as to how these note fields would actually work, and whether MS-Word could be used transparently within Rbase for updates.

All in all, it's really quite amazing how these Rbase enhancements correspond closely to the dBase III Plus enhancements.

Ian Davies

RBase system should have been released in the U.S. by the time you read this, and Microsoft in Australia expects to announce availability some time in September or October. Note that a run-time system has also been announced.

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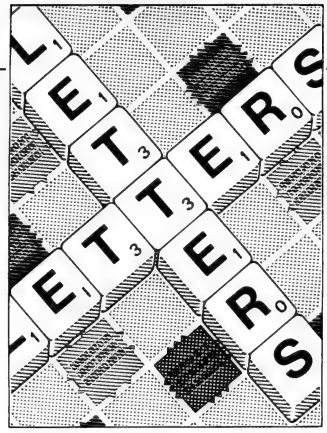

LETTERS

This is the chance to air your views — mail to 'Letters', Australian Personal Computer, 2nd floor, 215 Clarence Street, Sydney 2000. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Time to mature

I largely share Guy Kewney's disappointment regarding the recent decline of the West Coast Computer Faire ('Newsprint', *APC* June) which, in years past, was an exciting opportunity to feel the 'pulse' of a young, truly innovative industry — not to mention, of course, the chance to enjoy some terrific parties.

On the other hand, the Faire's slow deterioration may, after all, be a sign of the changing times, a sign associated with the growing maturity of the personal computer industry. To pre-empt the computer enthusiast who is about to yell 'Sucks!', I know that the word 'maturity' sounds like 'disaster' in the ears of the early hobbyists, the incurable hackers of yesteryear, and those who still believe that a PC primarily belongs in education and in one's home. Southern Californians are already talking about 'computer sociology' and 'computer philosophy' — disciplines which, in true American fashion, debate rather endlessly such 'trends' in the 'evolution' of personal computing.

'Maturity', however, may not be all that bad. While it definitely spells out the end of the shopping rush of the early 80s (which has equipped many an attic with orphans of the Commodore or Apple or even the PCjr variety) and it heralds an era of 'compatibility', 'stability', and 'software conformity' (something that petrifies the true computer nuts), it also creates the conditions for some serious work towards solving the technical problems that seem to make life harder for both private and business users alike: modem standard specifications, communications software, local area networks, and micro-to-mainframe links, to mention only those which come immediately to mind.

All in all, the personal computer industry, after a decade of frantic activity, seems to have finally settled and decided, or perhaps was forced, to get down to business. Those who decry 'compatibility' and 'stability' as messengers of doom of the 'fun' and 'satisfaction' involved in amateur home computing may have a point — but they also have to digest the fact that PCs are rapidly becoming vital *tools* in the place of work, a situation which in itself creates a vast majority of users who can happily, if boringly, live a lifetime with hardware-software products that are powerful enough to do the job, yet reliable and relatively simple to use.

Whether we like it or not, we're moving steadily in the direction of an environment where cost control, effective support and hardware compatibility will be the main determining factors. The message seems to be getting through even to successful innovators such as Apple. As I'm sure you've already heard, Apple's next big project is the creation of a 'bridge' with the PC/MS-DOS world, a 'communication link' that will certainly strengthen the Mac's somewhat sagging fortunes. As the Wonder Kids of yesterday grow older, they all seem to realise that 'meshing' with the rest of the world, and striking a balance between new technology and desk-top needs, are the all important conditions behind company financial-statement health.

Have we, then, sacrificed forever all that which made our earlier computing days so exciting and memorable? I think this is hardly the case. That we may not have one more goofy machine introduced every other month in the years to come, and that we'll be busy creating, improving and integrating computer *systems* instead of discarding orphans with all their paraphernalia, could in the end be a much more rewarding job combining 'fun' and 'satisfaction' with practical solutions for real-life problems.

AT Symeonides

You're right; and things will continue to be interesting, in both hardware and software, despite the imposition of an IBM standard. But there is, thankfully, still room for a maverick or two — and we all love an underdog.

Enigma — a counter-revolution

The major bottleneck in C Davis' splendid Enigma simulation program ('Enigma Variations', *APC* June) is quite easily eliminated in Basic. The key point is that the position of each rotor relative to its initial setting is uniquely determined by the 'increment-limit' variables N1, N2 and N3 respectively.

Provided they are constrained to the 0-27, rather than 1-28, their values can be used as positive offsets in the forward pass and, after reflection, as negative offsets in the reverse pass. This renders superfluous the data-shunting routines (lines 1300-1490).

The reverse pass, comprising three sequential searches, is itself a minor bottleneck which can also be eliminated. This requires three new arrays to hold the reverse links, say, DIM L1(28), L2(28), L3(28), and these should be set up within the 'FIT ROTOR' routine, using the cross-link relationship $R_k(X) = Y \rightarrow L_k(Y) = X$.

Implementation of these changes is quite straightforward, and reduces encipher timings by a factor of five. This may still be too slow for any serious application, of course!

A Simpson

Micro shock

At one point in the Toshiba 3100 Benchtest (*APC*, July), it was stated that the hard disk in the micro could withstand a shock of 70G. This sounds a lot, but it might be interesting to work out exactly what this means.

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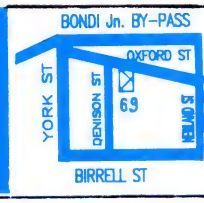

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surface. Something like a Golf GTi can corner at about 0.7G; an average fighter pilot can pull about 8G in a jet before blacking out. So, a figure of 70G for the hard disk on a computer would suggest that such a disk would be almost indestructible. However, anyone who has accidentally nudged a hard disk will have noted that it isn't necessary to throw it around in a jet to make heads crash and data vanish.

Going back to HSC applied maths to explain this apparent discrepancy turns up this very useful equation:
$V^2 = U^2 + 2AS$
where V is the terminal velocity, U is the initial velocity, A is the acceleration, and S is the distance covered.

Imagine someone putting their micro down on a table after a hard day reviewing it. The table is one metre high. They start putting the computer down, but due to the fatigue engendered by their arduous task, they accidentally drop it the last centimetre (0.01 metre). Although tables are hard, they are not infinitely hard. So, as a rough guide, let us say that when the micro hits the table, the table will give by some small amount: 0.1mm (0.0001 metre).

Using the equation: the initial speed was zero; the acceleration due to gravity is 9.8 metres per second; the distance is 1cm (0.01m) —
$V^2 = 0^2 + 2*9.8*0.01$
$V = 0.196$ m/s
so V = 0.443 metres per second.

In other words, at the point of impact, the computer is moving downwards 44.3 centimetres every second.

We can use exactly the same equation to work out what happens next. We have just worked out how fast the computer is moving downwards, and we have decided that, having hit the table, it will come to a stop in 0.1mm. This time, we know V, U and S and are interested in the acceleration, A. So,
$V^2 = U^2 + 2AS$
or,
$A = (V^2 - U^2)/2S$
$A = (0^2 - 0.443^2)/(2*0.0001)$
$A = (-0.196)/0.0002$

A = −980 metres per second per second (that is, decelerating), or 100G, which is comfortably beyond the 70G limit on the hard disk.

In other words, it's not the swinging it round your head which does the damage, it's the putting it on the table afterwards.

Paul Hardy

Thanks for the latest bulletin from the Bushlitt research team — we'll try to develop softer tables. Our offices don't have room to swing a computer, anyway.

APC criticism unfair

In reference to S Blair's letter published in the July issue of *APC*, in December 1985, I purchased an NEC APC III computer with the following specifications;

- 128k of memory (Standard)
- 20Mb hard disk
- Colour screen and associated colour graphics board
- 512k Omega memory board
- SLE board.

Obviously (unlike S Blair), I waited until I had received assurance from several people, including NEC, that the software I had visions of using, would run correctly under the SLE board.

I take S Blair's letter with some indignation, as I am a very satisfied NEC APC III user, and enjoy the 'S.P.E.E.D., and Screen Resolution' that this machine offers.

Some might think me a little crazy, but I purchased the machine as a fast IBM compatible, that had a very good name, and had a good

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Users marvel at the DL2400 LCD character display operator panel which allows them to select and configure all printer features with full prompting.

The DL2400 even has a colour option. Sure it emulates the IBM graphics printer but the DL2400 command set also includes all the options for setting different type-styles and modes.

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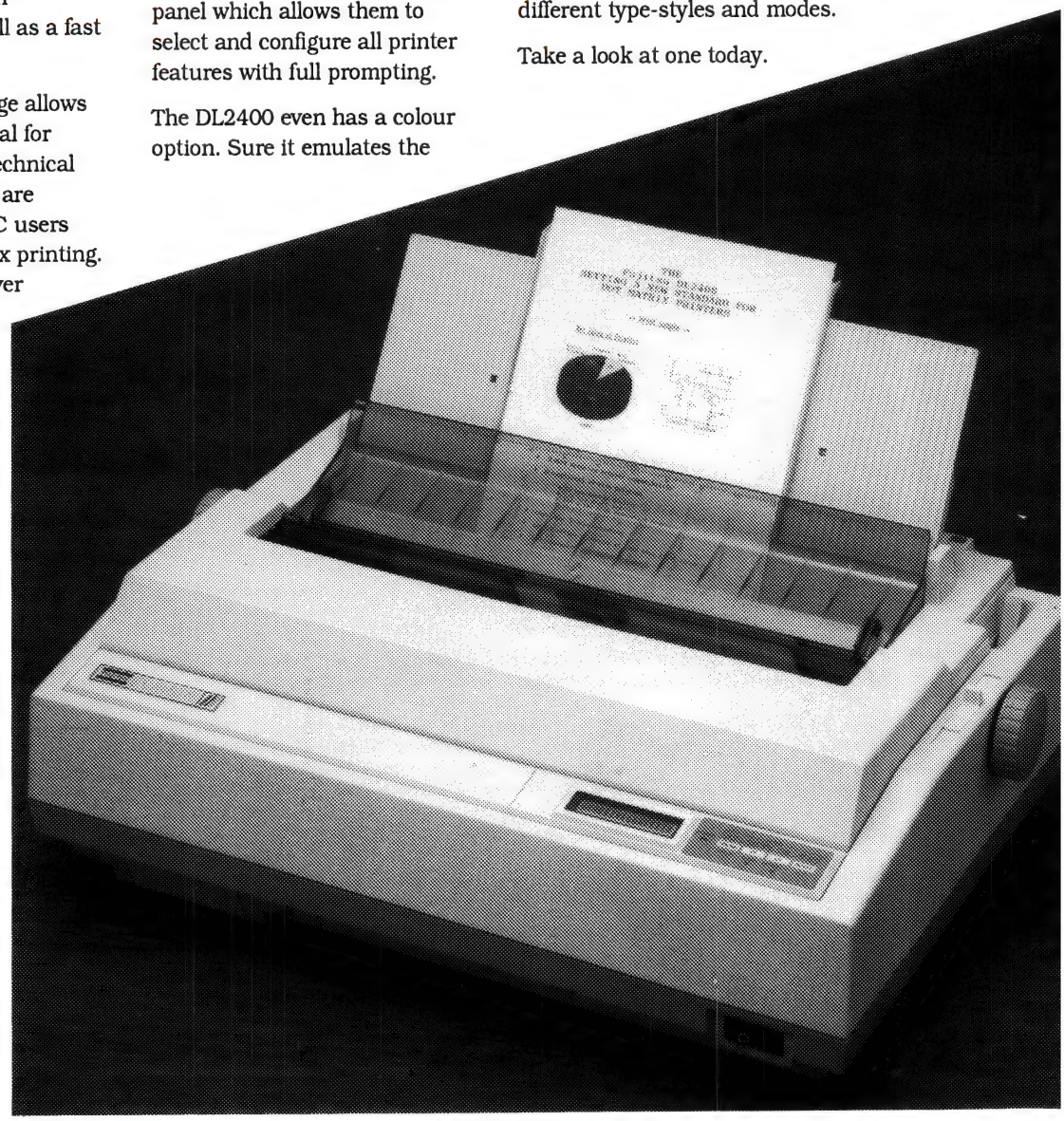

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service record.

Compatibility? I have tried the following software packages, and found them all to work correctly: Enable 1.1, Framework II, dBase III Plus, Sidekick 1.5, Xtree, WordStar, Turbo Pascal, Lotus 1-2-3, VP-Planner and more.

Sure, there are some packages that won't run. The ones that I have found include PC-Tools and Copy II.

I too, would dearly like NEC to release a 'better' board, but in the meantime, I simply love my NEC APC III.

How does the machine compare with a stock IBM or compatible? Well, one fairly large spreadsheet that I developed at work (1,000 rows plus), takes some 42 seconds to calculate on an IBM. The same spreadsheet on the NEC takes just 22 seconds flat.

D Walter

Speed not 8087 dependent

I was interested in your article 'Number Crunching' (February, *APC*), as it gave me something to compare with my own efforts at the Mandelbrot Set. Your program's performance is somewhat disappointing for a system using the 8087 as it is only 6 times faster than a Turbo Pascal program running on an APC III without 8087. It could be substantially improved by eliminating the redundant SQR function, and marginally by reducing the number of multiplications, as indicated below (the 8087 ADD is almost as slow as its MULT; these mods would have a far bigger effect on a system without an 8087).

However this is one application which dramatically demonstrates the virtues of assembly language programming. A program of mine, making imaginative use of integer arithmetic, will do your 19 hour calculation in 3 hours on the APC III, or 6 hours on a basic PC! I calculate that an optimum 8087 program, doing the entire inner loop inside the 8087, would run at about the same speed. HLLs insist on putting everything away in memory, and this takes forever, so I doubt if you will get within a factor of two of this performance using them.

I am hoping to publish an article on my methods so I can't go into more details at the moment.

R Riordan

END

```
a = 0. ; b = 0. ; n_max = 1000

while ((a + b) <= 4.0)
and (ocount < n_max))

a = az * az ;
b = bz * bz
bz = (az + az) * bz + bc
az = a - b + ac
ocount = ocount + 1

wend
```

Refer 'Speed not 8087 dependent'

When was the last time you backed up your PCs Winchester?

If you backup medium is floppies — It was probably a long time ago. Sitting down to your PC with forty to fifty floppies to back up your hard disc is a daunting thought. So daunting in fact, that in most cases it doesn't get done. — After all who can afford (or wants to spend) an hour or so each day on such a soul destroying task.

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SCREENTEST

MicroSoft Word 3

MicroSoft's Word 3 is a hefty upgrade of an old favourite, but does its complexity compensate for the shortcomings of its predecessor? Benjamin Woolley seeks satisfaction.

The launch of a new version of an old favourite always brings with it a mix of excitement and regret, pleasant surprises and disappointed expectations. While using a package over a period of months or years, most users compile a wish-list, a set of deep-felt desires that they hope the next version will fulfill. In the case of Word version 2, my wish-list was long. I wanted a built-in word counter, some form of outlining, proper windowing, a spelling-checker that could be used while editing, better print spooling... A thesaurus would have been nice as well.

Needless to say, with the release of Word 3, my wish-list has lengthened rather than shortened. However, real improvements have been made; there's no doubt that what has sprung from the loins of Word 2 is a better product.

New features

When Word 2 was launched, it was a significant departure from the world of WordStar. WordStar used the not altogether satisfactory principle that blocks of text were identified and edited using markers. So, to underscore or delete a block, you had to put a special marker at its beginning and another special marker at its end. Also, once a block was deleted, that was that; there was no way of retrieving it. The main problem with this approach was its messiness; you spent your time fiddling with silly markers rather than fiddling with the text itself.

Word offers a much more sensible strategy — a kind of paint and pick system. You select the text you want to work on (using a mouse, if installed), which is highlighted in reverse video, and then make whatever changes you want to make. Furthermore, selected text can be copied or deleted to an area of memory called the 'scrap', from where it can be brought back into the document, either at its original position or elsewhere. Using the 'glossary' facility it can even be given a name, and recalled later by typing in the name and pressing one of the function keys.

Word also has a much cleaner formatting system. Document formats can be stored separately from the documents themselves in a 'style' sheet, so, if you want to change a document's format, you simply attach it to a different style sheet. These types of facilities make the package exceptionally powerful and easy to use. From the start, Word looked like a winner.

One feature that's common to almost every new software release is the escalation in the number of disks and the size of the manuals. Word 3 comes on no fewer than six disks (four for Word itself, plus two for the tutorial) and three manuals (for usage, reference and printer installation).

Installation

Installation is simple, requiring only that you slide in the utilities disk, type 'set-up', answer a few prompts, and leave the rest to the software, which makes working copies of the appropriate files on another set of floppies or on the hard disk.

Thankfully, there's no copy protection — indeed, MicroSoft hasn't even bothered to cover the write-protect notches on the master disks. This decision is to be applauded, not because it encourages piracy, but because it means users can organise their disks in a way that suits them rather than MicroSoft.

In use

Word 3 is a superset of version 2, rather than a major rewrite. It uses the same screen design, the same system for selecting text, and the same MicroSoft-style menu (two lines of options displayed at the bottom of the screen). It also runs at about the same speed which, on an AT clone used for this test, is good, with the screen scrolling at a smartish pace and operations like search/replace taking no more than a few seconds.

Most welcome is the outlining facility. Version 2.01 of Word came with an outline processor called Ready! bundled (reviewed in *APC*, June 1986), but it wasn't an integral part of the program. Now, an outline facility has been built-in.

Outlining, for those yet to encounter it, is designed to help compile notes, structured hierarchically into headings and sub-headings. Each heading has a 'level' associated with it, and the levels are shown using indents. The main heading is at the first level, a sub-heading at the second (indented once), a sub-sub-heading at the third (indented twice), and so on. Levels can be hidden, so you can see the broad outline without being distracted by the detail. For example, by pressing the minus key on the numerical pad, you can 'collapse' a heading's sub-headings, so only the main heading is displayed. You can 'expand' an entire outline, so all headings

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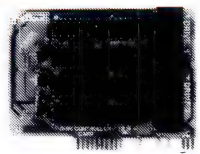

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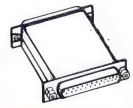

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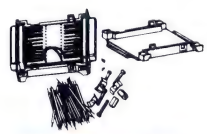

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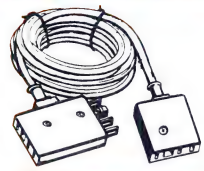

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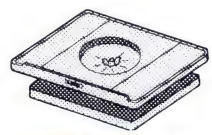

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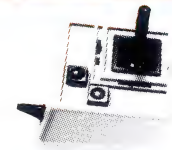

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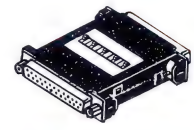

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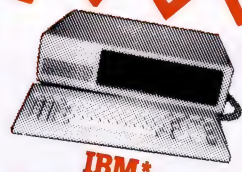

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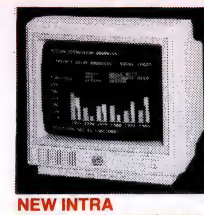

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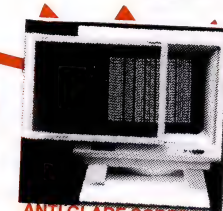

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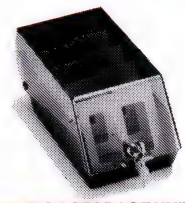

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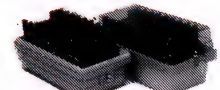

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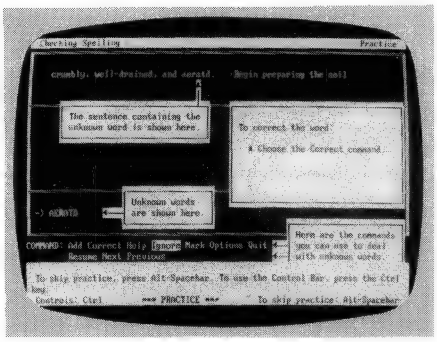
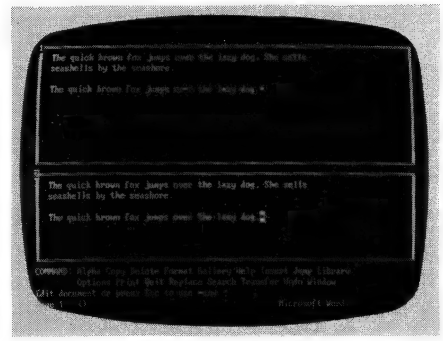
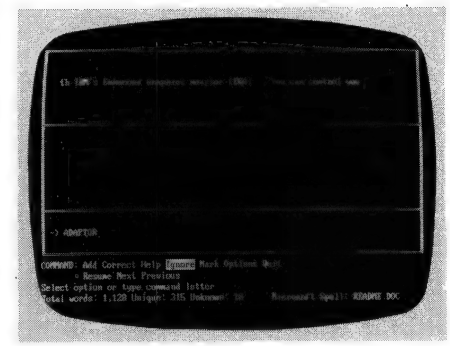


The interactive Word tutorial



Multiple windows on a document



The spelling checker in action

are shown, by pressing the '*' key.

Thus far, Word 3's own outlining facility is the same as outline processors like Ready! and ThinkTank. However, being built into the word processor, it ceases to be something separate from the document being edited. Instead of invoking the outline processor as you would any other program, you switch to an outline 'view', simply by pressing a function key. When this is done, Word attempts to turn the document being edited into an outline. How well it does this depends on the document's format. If it's a normal text format, the outline is simply a set of paragraphs marked as blocks of text (rather than headings). However, you can attack a style sheet that is able to distinguish a heading's level. To explain this, we need to divert to Word's formatting for a moment.

As with Word 2, one of the commands available from the menu is called 'Gallery'. By executing it, the screen is switched to a display that shows the format parameters of the style sheet attached to the document (assuming one has been attached). Each parameter is for a paragraph or 'division'. Paragraph formats concern a paragraph's typeface, positioning (whether it's aligned to the right or left column, centred, or justified) and line-spacing. Calling it a 'paragraph' format is a bit of a misnomer, as the format can apply to a whole document. It's called that to distinguish it from the parameters set by the 'division' format, which concerns page dimensions.

You can have a number of different paragraph and division formats in one style sheet, each identified by a 'variant number', a two-letter code which is used to invoke the format while editing, and a remark to remind the user of the format's use. The user chooses all three. The two-letter code is whatever you want it to be (perhaps 'CE' for a centred paragraph), but the variant is chosen from a list. When you have chosen the variant number, you then set the format parameters that will be associated with it. Some variant numbers, however, include preset parameters; these are for formats that will be used in contents and index lists (see below) and outlines.

By selecting a preset outline variant when compiling the paragraph formats in a style sheet, you can then give a paragraph an outline level while editing it. When you switch to outline view, it will be indented accordingly. If this sounds horribly complicated, it is. One of the weaknesses of Word, versions 2 and 3, is that some of its more advanced facilities, especially the style sheets, demand a period of committed study. Some of this complexity is only to be expected in such a sophisticated package, but some, particularly the variant numbers, is needlessly confusing and could have been simplified. That's one item on the wish-list that remains.

This complexity unfortunately extends to the outline facility. Once the outline view of a document has been selected, there are two modes for manipulating it, called 'text edit' and 'outline edit'. You toggle between them by pressing a function key.

Basically, the distinction between the two is that in text edit mode you edit the text within each heading, while in outline edit mode you manipulate the outline itself. The reason for the distinction is sensible enough; when editing text, you shouldn't be able to accidentally alter the outline's structure. However, it can get confusing. In outline edit mode, the cursor keys take on a different function when moving through the outline. Up and down moves between headings at the same level while left and right move between headings at different levels. In text edit mode, the cursor keys behave normally. Headings can be expanded and collapsed in both modes, but only in outline edit mode if you're using the mouse.

Word will automatically number the headings in an outline, which can be useful. You can either use the standard numbering system (which uses a mix of Roman and Arabic numerals and alphabetic characters) or 'legal' notation (1., 1.1, 1.1.1, and so on). This is extremely handy for, say, numbering the headings in a report. Blocks of text are not numbered, nor are they indented, though for the purpose of collapsing and expanding headings, they have the same level as the preceding heading.

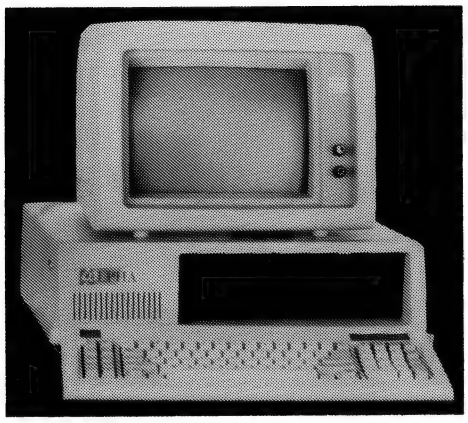
One of the strengths of Ready! was its simplicity; sadly, this simplicity hasn't found its way into Word's outlining. What with all the modes, the style sheet variants and the different key functions, it's easy to end up in a mess. Nevertheless, it's an asset; no word processor should be without it.

Indexing

No sophisticated word processor should be without an indexing system either. Word 3 happily includes one, plus a contents compiling system. Both of these exploit a new character format — hidden text. Instead of formatting characters as bold, underlined, or whatever, you can declare them as 'hidden', whereupon they are either displayed on screen with a dotted underline or, by changing one of the options using the 'Window' command, removed from the display altogether.

Hidden text is useful for adding notes and reminders within a document which aren't for printing. Most other processors already have a similar facility (WordStar 2000, for example), and it was noted in Word 2 for its absence. But it performs a double function, one which unfortunately reverts to the old WordStar style of marking text. When you edit a document, you select the window option for displaying hidden text. You then type, in hidden text mode, '.i.' before every block of text (usually a word) you want included in the index, or '.c.' if you want it included in the contents. The end of the block of text is marked with a hidden semicolon. The difference between index and contents is that the index table is sorted by entry, while the contents table is sorted by page number.

The system works very well. Like outlines, both index and contents can be organised into 'levels', so, in the index,



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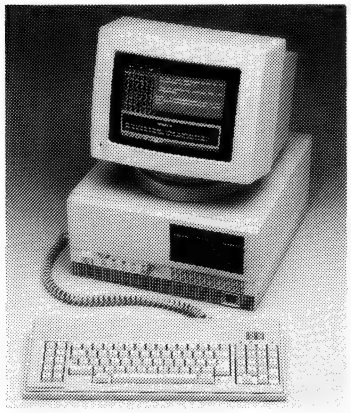

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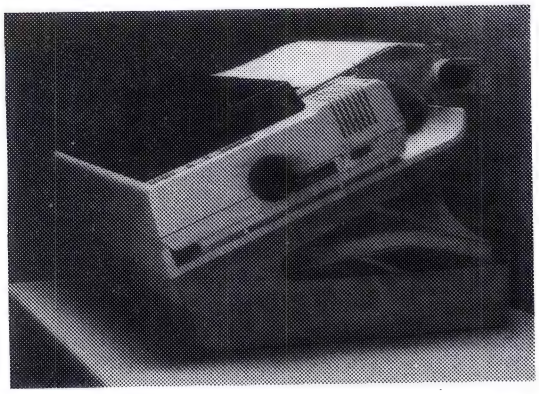

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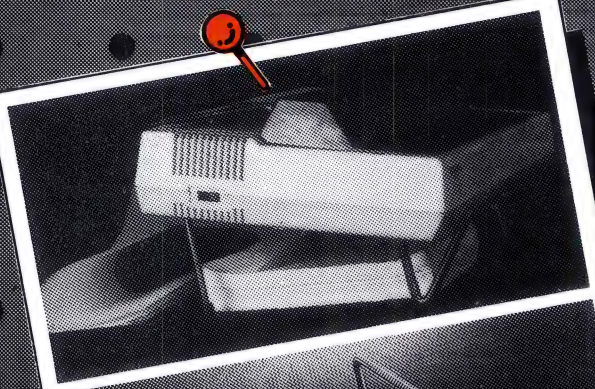

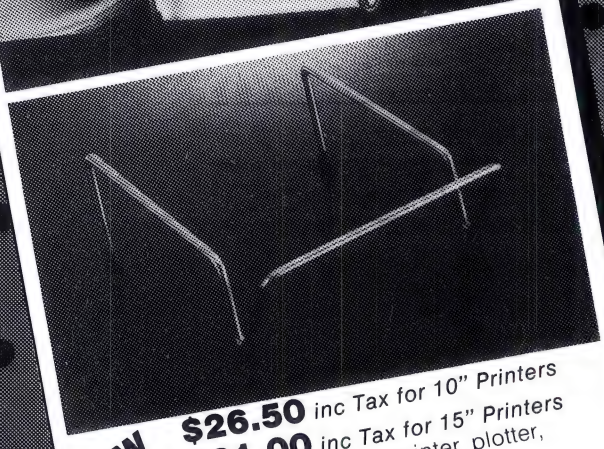

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* Security key to stop unauthorised access
* Front reset button
* Parallel printer port
* Joystick port
* Light pen port
* Battery backed up clock
* Hinged lid for easy access
* Sculpted ergonomic keyboard
* 4 layer board for reliability

FREE SOFTWARE

SPECIAL SELECTIONS FROM THE PUBLIC DOMAIN (02) 29 2866

CP/M-80

DISK No.

CP1 **GAMES.** Menu-driven, compiled games, including an excellent one that prints bio-rhythm charts, a clever horse race, and a space trader programme for the wheelers and dealers.

CP2 **GAME.** A 191k version of adventure, the classic game which can absorb your attention for days at a time. This is a 550pt version with an expanded cave and smarter creatures.

CP3 **GAMES.** More fascinating games to absorb time you can't spare — such as a six level chees game, Othello, a well-written multi-level version of Pacman and an extensive Wumpus adventure game.

CP8 **GAME — BOTTICELLI.** An extensive word-guessing game in which you think of a person's name and the computer tries to guess it. You can add names to the list. Compiled in Turbo Pascal, with source code provided.

CP9 **TURBO PASCAL GAMES.** Includes CH, a game similar to go-moko. Try to place markers before the computer prints a pattern. DICE for those with a gambling streak, one of the best LUNAR LANDER games around, a word guessing game which tells you how many characters were correct and in right position, plus a typing copy game to match words on screen.

CP21 **UTILITIES.** A whole heap of useful programmes to catalogue your files, arrange the directory display, make emergency alterations to the disc, allow printing and computing at same time, count words, print the screen, copy better, erase, unerase, delete, make batch commands, etc.

CP28 **UTILITIES.** A super collection of some of the best utilities available, such as NEWSWEEP, NULU (file library), SUPER-ZAP and VDO (edit).

CP31 **PERSONAL MANAGEMENT.** HANDY is an integrated collection of utilities for keeping track of appointments, planning, listing tasks, goals and reminders, planning action, notebook, phonelist, and making decisions.

CP32 **DISK DOCTOR UTILITIES.** Contains two major disc edit programmes written in Turbo Pascal. Compiled for immediate use. Source code provided. Probe will view and edit sectors, find bad sectors, copy blocks to a new location, and search for text strings. Works on hard disks, ram disks and floppies. Rescue lets you search memory for text that you've written — and lost when the computer crashed.

CP42 **TYPING TUTOR.** An easy to use, menu-driven programme.

CP43 **TEXT EDITOR.** This is Express V1.01, a full-screen text editor which also allows macros to reduce tedious operations to a single stroke. Formatting facilities on the disk will do page numbering, centering, justification, superscripts, subscripts, special fonts, and more.

CP63 **GRAPHICS — DRAWING.** Allows you to edit, rotate, merge, etc. any image you draw on the screen. Is compiled and set up for 1984 Kaypros but the Turbo Pascal source code is provided if you wish to adapt it.

CP84 **TURBO PASCAL UTILITIES.** Enhance your programming with listing, sorting, printing, auto-menu and mathematical functions, etc.

CP85 **TURBO PASCAL SCREEN GENERATOR.** Simplifies development of screens for menus, data, forms, etc. Concentrate on presentation rather than programming.

CP101 **COMMUNICATIONS. TURBO PASCAL BULLETIN BOARD.** A complete bulletin board package that has been highly praised by others.

CP102 **COMMUNICATIONS. MDM730.** A popular and widely used system. Easily adapted to different machines. Source code and extensive documentation is included. An Apple/CPM version is also available.

CP141+ **DBASEII APPLICATIONS.** A powerful collection of 5 discs with fully developed applications packages, programme extensions and algorithms. Includes super mail-management, inventory control, phone tracking, budgetting, graph-making facilities, patches, checking for duplicate entries, menu creation, and many more. $50 the set instead of $75.

CP203 **EDUCATION — FOREIGN VOCABULARY BUILDER.** Teaches a foreign language vocabulary. Can be used to build lessons in various languages. Simple lessons in french are included. Compiled in Turbo Pascal, with source code provided.

CP501+ **MICROBEE SELECTION.** A set of three discs of utilities and games that have been tested on the Microbee. Dozens of games, including Adventure. many with source code. $30 for 3 discs instead of $45.

APPLE II

DISK No.

A1 **GAME.** Trivia quiz game. Extensive with built-in editor for adding, changing, deleting questions.

A2 **SELECTED GAMES.** Has some beaut games, including a collection of pinball games called Flip It, Maxx's Madness, Super Blast, The Maxx Machine and more.

A3 **ADVENTURE GAME — EAMON.** The Beginners Cave. First in the series — meet the monsters. This disk is essential for playing other games in the Eamon series.

A4 **ADVENTURE GAME.** Minotaur's Lair. A3 is also required.

A5 **ADVENTURE GAME.** Death Star. A3 is also required.

A6 **ADVENTURE GAME.** Devil's Tomb. A3 is also required.

A7 **ADVENTURE GAME.** The Clone Master. A3 is also required. Cost for adventure series (A3-A7) is $15 per disk or $50 for the five disks instead of $75.

A10+ **CREATE ADVENTURES.** Create your own dungeons and dragons adventure games with this 4 disk set of programmes. Compatible with Eamon series above. Creative and entertaining. Also suitable as an educational aid. $40 for 4 disks instead of $60.

A21 **SUPER UTILITIES DISK.** Has disk catalogue manager, menu maker, file manager, DOS command menu, text file reader and more.

A41 **WORD PROCESSING.** Contains a very useful text editor.

A42 **BASIC & ASSEMBLER TUTORIAL.** Very nice introduction to programming.

A101 **COMMUNICATIONS.** A collection of modem and utilities programmes for communicating with bulletin boards etc.

ACP102 **COMMUNICATIONS.** Requires CP/M and Z80 Board. MDM730 is a full featured programme already configured for Apple Contact bulletin boards, etc. with this exellent modern programme.

A121 **ACCOUNTING AND FINANCE (1).** Broad finance package that does budgetting, interest & loan calcs, values shares, bonds, annuities, etc.

A122 **STATISTICAL ANALYSIS.** Comprehensive selection of mathematical and statistical programmes including calculus, vector analysis, regression (exponential, geometric, linear, polynomial, etc.) mean, variance, standard deviation, chi square, F distribution, t test, Mann Whitney U test etc.

A123 **ACCOUNTING AND FINANCE (2)** Programmes for depreciation, inventory, leases, stock market forecasting and trend line analysis.

A124 **ACCOUNTING & FINANCE (3).** Very useful business programmes for cheque payments and general ledger.

A125 **ACCOUNTING & FINANCE (4).** A menu-driven system for keeping track of personal accounts — suitable for home-use and non-acountants. Easy to use.

A126 **SPREADSHEET.** Basicalc is a comprehensive calculating programme in the spreadsheet tradition. Good documentation on the disk.

A141 **DATABASE MANAGEMENT.** An excellent public domain programme that supports two drives, an 80 column card, and most printers. Has good instructions and a help file. Has facilities for merging, editing, searching, etc. There is a sample on the disc also.

A201 **EDUCATIONAL GAMES.** Requiring deduction. E.G. murder mystery, adventure (hunting monsters), Jigsaw puzzle (manipulating shapes), lotto, etc.

A202 **EDUCATIONAL MIXTURE.** Being more assertive, additions, perimeter, area, linear equations, division, logic practice, etc.

A203 **EDUCATIONAL — MATHS.** (Mostly primary level). Midpoint, ratios X-Y graphs, math-dice and a good ecology simulation.

A204 **EDUCATION — PRIMARY MATHS.** Includes additions, multiplication, roman and other numerals. Has timer to "beat the clock".

A205 **EDUCATIONAL MIXTURE.** Programmes for speed reading, remedial reading, anagrams and maths — equations, function graphs, polygonal patterns, prime numbers, sine, subtraction, tables, etc.

A206 **EDUCATION — PHYSICS/MATHS.** Vectors, kinematics, gravity, motion, momentum.

A207 **EDUCATION — GEOGRAPHY.** Quiz on countries, capitals, continents, has agriculture, water pollution, rainfall, salinity, weather.

FREE SOFTWARE

SPECIAL SELECTIONS FROM THE PUBLIC DOMAIN (02) 29 2866

Well, almost free. We don't charge for the public domain software but there is a small service charge of $15 per disk to cover promotion costs, selection, testing, copying, etc. Disks are available for CP/M, MS-DOS and APPLE. Mail and telephone order only.

The programmes have been carefully selected, tested and documented. They'll run on a wide variety of computers that accept 5¼" disks. We have tried to choose programmes as machine-independent as possible. However we cannot guarantee the suitability of programmes for your particular machine. Wherever possible we include source-code.

MS-DOS programmes are aimed at the IBM-PC and close compatibles. The NEC APC III will often require the software library extension card to be able to execute these programmes. Documentation is included on the disks where required — often it is very extensive. Unfortunately, we are unable to provide telephone tutorials on using the programmes.

MS-DOS disks are formatted for standard MS-DOS 2.11 360K. Testing has been carried out for CP/M disks on a Z80 Kaypro II. About 120 different formats are supported, including Kaypro, Osborne, Tandy, Microbee, Bondwell, Commodore 128, Televideo and Apple II, but not Commodore 64.

MS/DOS

DISK No.

M5 **SUPER COMPILED GAMES.** Eight arcade games for those with colour graphics adaptor. Very absorbing. Includes Pango, Gold, Pyramid, 3-Demon, etc.

M8 **SELECTED FAMILY FUN GAMES.** A flight simulator, music generator, excellent Pacgirl, space wars, etc.

M21 **UTILITIES.** These are essential and include file maintenance superstars like **SWEEP** and **WASH** as well as library and squeeze/unsqueeze programmes. Lots of them.

M23 **UTILITIES.** Make life easier for yourself with programmes like Util, Z, Vtype, ST, Protect, Unprotect.

M25 **SELECTED UTILITIES.** Dozens of highly useful utilities, with documentation, compiled and ready to go. Includes Autodex (super file manager), Membrain (ramdisk) Squeeze and Unsqueeze, Directory Printer, Calendar, File Finder (great for hard-disk), Keyboard Definer, etc.

M26 **UTILITIES FOR PERSONAL MANAGEMENT.** Similar to sidekick, these are background utilities that provide calculator, notepad/editor, phone index, alarm clock, calendar, printer controls, typewriter-simulator, window access to directory, display/remove/copy/rename files, etc.

M27 **UNPROTECTION METHODS.** Hints and programmes that help you to back-up a variety of copy-protected programmes. New 3 disk set for $30 instead of $45.

M29 **DISK LIBRARIAN.** A collection of some of the best programmes available for cataloguing your disks and keeping track of files. Provides an alphabetical master list, etc.

M32 **DISK DOCTOR COLLECTION.** Some of the best debugging and file repair programmes around. Includes Jaz, Easy-Zap, Diskit, etc. Ok for hard disks too.

M41 **WORD PROCESSOR.** Considered at least as good as the commercial programmes. Contains PC-Write, latest version 2.6 plus extensive manuals. For editing and formatting.

M43 **MULTI-FRONT WRITER.** An incredible word-processing package that prints out scientific notation, Greek letters, gothic, italics, etc. Recommended.

M48 **OUTLINER FOR WORD PROCESSING.** Considered by many to be the best outliner/ideas processor available. Is fast, can be memory resident, has windows, excellent printing features, etc.

M61 **GRAPHICS.** A selection of some of the best programmes in the public domain, including an extensive picture-graphics set of commercial standard.

M85 **LANGUAGE — PASCAL.** One of the most popular languages for general programming. Well-documented. A very good choice for learning to programme.

M87 **SCREEN DESIGNER.** An easy to use interactive screen designer to assist you with your programmes. Suits Basic programming.

M91+ **TURBO PASCAL LIBRARY — SET 1.** Special set of routines, aids and utilities for programming in Turbo Pascal. 7 Disks for $70 instead of $105.

M92+ **TURBO PASCAL LIBRARY — SET 2.** Special set of routines, aids and utilities from Turbo User Group for programming in Turbo Pascal. 6 Disks for $60 instead of $90.

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M128+ **INTEGRATED SPREADSHEET.** A two disk set of a comprehensive spreadsheet programme. Has Basic and compiled versions with documentation. $30 for 2 disks. Includes integrated word processor/spreadsheet/database/graphics.

M129 **1-2-3 UTILITIES.** Highly regarded collection of utilities that enhance the operations of Lotus 1-2-3.

M132+ **1-2-3 WORKSHEETS.** Comprehensive special set of worksheet, aids and utilities for lotus 1-2-3. $80 for 8 disks instead of $120. (Does not include M129).

M141+ **DBASE 11/111 APPLICATIONS.** Extensive group of Dbase applications, programme extensions and algorithms. Includes cheque programmes, mail management, inventory control, budgetting and accounting, memo maker, phone index, menu drive, typewriter simulation, depreciation, automatic formatting, search for duplicate entries, Spanish lessons, runtime decorder, graphics and other utilities. Set of 5 for $50 instead of $75.

M143 **FAMILY TREE/GENEALOGY.** Extensive programmes in basic for recording, tracing, grouping, printing, etc., family relationships.

M147 **DBASE 111 SCREEN/CODE GENERATOR.** Greatly reduces the amount of programming you need to do. Much of the coding is generated to include in your own programme.

M149 **FORMS AND REPORTS.** A forms generator for displaying information contained in data bases. Compatible with PC-File also.

M150+ **SUPER NEW DATA BASE MANAGER.** File Express suits sales/-stocks/mailing/personnel/payroll. Will calculate, print invoices, labels, etc. Compatible with PC-File. Two disk set $30. Very good documentation.

M201 **EDUCATION.** BASIC TUTORIAL. How to programme in Basic. Onscreen demonstration and explanation.

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you could have 'Word' as one entry with 'Outlining', 'Indexing' and 'Editing' as sub-entries. You do this by placing '.c.Word:' before the appropriate text. The colon indicates the level, and several colons will lower the level accordingly.

One of Word 2's most glaring omissions was the absence of facilities for dealing with tables — that has all changed. For a start, you can now select 'column' blocks. By pressing one of the function keys, the position of the cursor is assumed to be the top left-hand corner of a box, and you can set the bottom righthand corner by moving the pointer. For example, you could highlight a table set in the middle of the screen without having to select all the surrounding text on the same lines (not possible with Word 2).

When a block has been selected, calculations can be performed on any numbers within by pressing one of the function keys, with the result being put in the scrap for insertion elsewhere in the document. Blocks can also be sorted alphanumerically, in ascending or descending order.

The wish-list

The addition of outlining, indexing and table manipulation, all of them welcome extras, has made Word 3 substantially more sophisticated. Add to this some of the strengths of the original, like the ability to edit documents larger than memory by paging to and from disk, and Word 3 emerges as a formidable product.

But the wish-list is still there. Why, for example, is the windowing still so primitive? Although you can fit several documents, or several bits of the same document, on the screen at once by opening windows, and though the windows can be almost any rectangular shape, you still can't have any overlap, nor can you 'zoom' up a window to fill the screen temporarily.

Why is the word counter still bolted on like an optional extra? It's irritating having to save the document being edited and use the Library command (used to run DOS programs from within Word) every time you want to find out how much you've written (especially when you're paid by the word). And why can't a word's spelling be checked while editing a document? The spelling-checker may be good (it'll even manage phonetic matching to suggest alternative spellings), but it too is bolted on. And why isn't there any support for telecommunications? And though the hidden text facility is useful, why can't documents be separately annotated so you can keep track of their contents?

Documentation

Word 3's documentation is something of an improvement on its predecessor's. The addition of a manual on installing printers is useful, especially for those who want to use the MAKEPRD program (an update of Word 2's CONVPRD) to compile their own printer drivers. The number of printer drivers is ever growing. Word can even drive a laser printer or typesetting machine using the Postscript language.

Unlike other word processors, Word can't, as the printer manual admits, compensate for printers which are unable to print bi-directionally with micro-justification. Word's print formatter isn't capable of making up for a printer's lack of intelligence, which is irritating for those with older, less sophisticated printers.

The user and reference manuals are nicely designed and written, and, given the awe-inspiring complexity of some of the facilities, walk you through the system at an easy pace.

Word 3 also has a tutorial, in two versions: one for use with the mouse; the other for keyboard only. Both have the up-front friendliness customary in software tutorials, but offer a good introduction to the system. What's more, the context-sensitive help within Word can be used to call up an appropriate lesson from the tutorial.

Price

Word 3 costs $845 ($1095 including Microsoft's Mouse), and anyone who bought version 2 after 1 May 1986 can upgrade free; otherwise it's $125.

Conclusion

With more basic word processors now available for under $200, the value of packages like Word has to be seriously questioned. What do you get for those extra hundreds? Well, for a start, you get a marvellous text editor, thanks to the pick-and-paint selection system for editing blocks of text. You get a large 80,000-word dictionary (no thesaurus, though), a decent spelling-checker (let down by the fact that it's not integrated), mail-merge, footnoting and windowing. Now you get indexing, table manipulation and calculation facilities as well. And, perhaps best of all, you get outlining, the facility that word processing has been waiting for. That's quite a lot. But what you also get is complexity. For some it might be too much, an overwhelming cacophony of bells and whistles.

Packages can bear the weight of only so many extras before they become unwieldy. Word isn't quite unwieldy, but it's no lightweight rapier either. Since it doesn't support telecommunications and won't run under MicroSoft's Windows (not properly, anyway), its future appears limited, and MicroSoft is likely to sink further development effort into the Windows word processor, Write.

But for those who are sticking with PC-DOS, and who need a lot of word processing power, the new version of Word must be a top contender. It may lack elegance, but it packs plenty of punch. END

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Softerm is also available in versions for the NEC APC III, Tandy 1000/1200, Wang PC, TI Professional, DG1, Gridcase and Apple IIe & IIc, Macintosh version coming soon.

New Release 1986

Additional protocols available in the 2Q86 release of Softerm PC will include KERMIT (the public domain protocol developed at Columbia University), Hayes Verification Protocol (Smartcom), and CLINK (Crosstalk).

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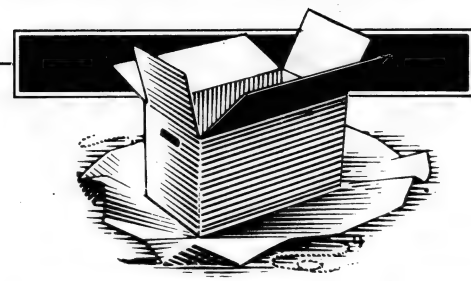


WHAT'S NEW

Despite pundits' claims that we're in for a reduced rate of new products released, the industry continues to announce vast numbers of innovative new products — far too many, in fact, to cover in Newsprint. So we've decided to launch a new column, What's New, devoted to covering the most important and interesting new products each month. Ian Davies launches into it . . .

Microcomputers

Aussie produces world's fastest PC

The Melbourne based design and manufacturing company Earth Computer Systems, has the distinction of producing what it claims to be the fasted IBM compatible machine in the world.

Known as the ECS-286/30, the machine runs an Intel 80286 at 10Mhz, making it one of the fastest processors around. However coupled with no wait state memory and an 18ms voice coil hard disk, the machine becomes a world beater.In fact, at the November Comdex in Las Vegas, the ECS-286 took on all comers, running rings around them all. The ECS-286 provides more than 10 times the throughput of the humble IBM PC, and outruns at AT by 3 to 1.

Earth Computer says it understands that the ECS-286 is a specialist machine for people with particularly high horsepower requirements, but they might just be surprised how many men in the street want fast machines. The ECS-286 is certainly priced reasonably, just $6,975.00 for a 30Mb disk version with 640k.

Apparently orders are already outstripping manufacturing capacity, and as a result of the Comdex bloodbath, ECS is having to fight off American dealers. So you might have to move quickly to get yours before the rush.

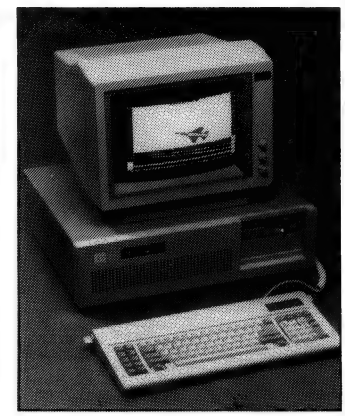
One word of warning. ECS seems to be quite happy to tell everyone what incompatibilities there are between its machine and the standard IBM AT, and how to deal with them. Don't let that put you off. The company is just being refreshingly honest, and you'll find that any other high performance AT compatible has just the same problems. It's just that no-one else admits to them. ECS are on (03) 439 4900.

Vision AT compatible

Vision Computer Corporation has just announced the availability of an AT compatible machine called the ATsm super microcomputer.

The machine runs an 80286 at 8Mhz, but is switch selectable to 6Mhz. It comes standard with 640k of RAM and a 1.2Mb floppy drive, and can optionally include a 30Mb hard disk. The hard disk uses voice coil technology, with an average access time of 36 msec.

The system is available with a monochrome monitor for $6495, or with colour for $6795. For those who find such things unnecessary, the Vision machine can be purchased minus display and adaptor for $5995.



More information is available from Vision on (02) 925 0666.

Smallest PC compatible

It had to happen.

Discware has announced the introduction of the first hand-held IBM compatible computer, called the Datacomputer.

The 1.1kg machine runs MS-DOS on a 80C88 running at 4Mhz, giving it the distinction of being the only machine I know of which actually runs more slowly than a IBM PC. Memory is 128k standard, expandable to 256k. Three AA size batteries provide up to 70 hours of operation,

/Micro/Mania

SOFTWARE

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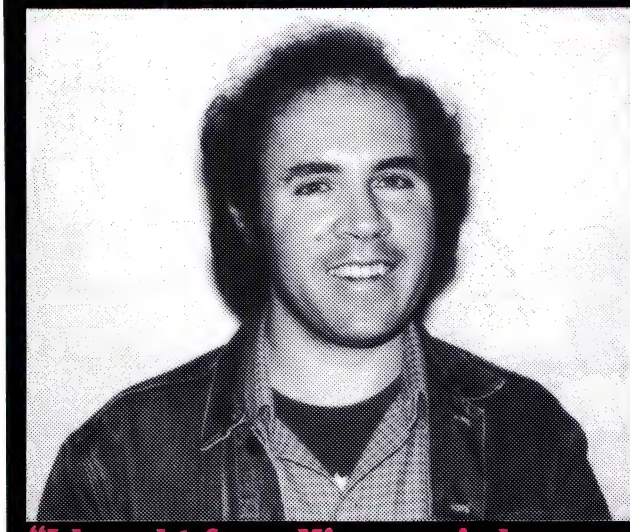

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Netcomm SmartModem 1200	749
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with lithium cells backing up memory for up to 7 years. The display is two lines of 24 characters, making it doubtful that the new machine can actually run Lotus 1-2-3 or Flight Simulator.

The machine doesn't actually run MS-DOS, it runs NS-DOS, a 32k ROM resident MS-DOS compatible system developed by National Datacomputer. An RS-232C port is provided as standard.

The beast is physically 28 × 12 × 6cms, and sports a nifty 27 key keyboard. Acknowledging the limitations of the 27 key format, input may also be provided via a bar code reader.

Really, this machine is more a portable bar code reader and data acquisition unit for people who want to be particularly tricky, rather than a hand-held IBM PC.

Discware doesn't seem too sure of the price just yet, so if you're interested call on (02) 212 6933.

Amstrad leak

Mitsubishi has carefully leaked the imminent arrival of the next generation Amstrad computer.

Company spokesmen have let everyone know that the new machine, due for release around the time you're reading this, is aimed more at the business sector while still maintaining the price/performance advantage of its earlier releases. Somewhat inevitably, the new machine will have a degree of IBM compatibility.

Mitsubishi AWA, the Australian distributor for Amstrad, is pretending to be tight lipped about the whole thing, presumably in an attempt not to be left with warehouses full of old Amstrads.

If you want to annoy someone about it, call (02) 29 5044. It's not Mitsubishi, but it's the next best thing — the PR company.

SNS goes AT compatible

The Sydney-based SNS group has announced an AT version of the Leading Edge PC-compatible computer.

Known as the Leading Edge Express, the machine comes equipped with a standard 640k of RAM, a 30Mb Seagate hard disk, and runs at 8Mhz.

Certainly the SNS machine should provide AT performance, and at a recommended price of $5748 including monochrome monitor, could prove very competitive.

SNS can be contacted on (02) 438 2665.

Tandy releases new portable

Tandy Electronics has revamped its successful Model 100 lap-top computer into the new Model 102.

The Model 102 runs an 80C85 microprocessor at 2.4Mhz, and comes standard with 24k of RAM which may be expanded to 32k. The Model 102 weighs just under two kilograms, and has a thinner profile that the old Model 100, being just 3.8 × 30 × 21.6cms.

The display is eight lines of forty characters and is accompanied by a 56 key keyboard. Built-in ROM software includes a Basic interpreter, text editing, telecommunications, address/telephone filing and appointment record keeping, attempting to meet most users' immediate computing needs.

The Model 102 includes RS-232C, parallel, cassette and bar code reader interfaces. Tandy claims it includes a built-in 300 baud auto-dial modem. The machine operates for up to 20 hours on four "AA" batteries, and may also be powered from an optional AC adaptor. Internal Ni-Cads maintain memory contents for up to 30 days between use.

The Model 102 sells for $995, and is available from all Tandy stores.

Peripherals

Give your dog a disk

If someone smudges fingerprints all over one of your disks, possibly your best bet for getting the data back is to let your dog chew the disk. So says Polaroid, who has introduced their own brand of 5.25, 3.5 and 8in floppy disks, all of which come with a 20 year guarantee and a unique data recovery service.

Polaroid claims its disks are better due to the non-woven liner which continually cleans the diskette in use. The disks are manufactured in 'clean room' conditions, and are delivered in 100% error free condition. The diskette hole is reinforced with a gold hub to reduce wear and ensure accurate alignment.

Uniquely, Polaroid offers a recovery system for damaged diskettes. Field tests have shown that 100% of data can be recovered following frosting, thawing, floating in coffee, chewing gum, soap, attacks with ball point pens, cigarette ash, and harassment by dogs. Fingerprints are a little more difficult, according to Polaroid, due to the acid present in the oil on some fingers. Polaroid could only manage a 98% recovery on diskettes riddled with staples, which may sound pretty good, but when that 2% is the disk directory or FAT, things can get a little tricky.

The only drawback is that the disks have to be sent to the US for the recovery service, but the local contact is Polaroid in Sydney. So if someone touches up one of your diskettes, stick a lump of chewy on it and call Polaroid on (02) 887 2209.

Two megabytes on 3.5in floppy

Furthering the cause of the 3.5in microfloppy, Verbatim has announced a limited availability of diskettes capable of storing 2 megabytes.

Unfortunately, the disks are only being made available to companies who are trying to make the disk drives these floppies are supposed to run in, so it may be some time before they hit the streets in your local store.

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Verbatim has managed to coat the disks with a layer only 1.4 microns thick, sustaining up to 17,346 bits per inch. The more rigid construction of 3.5in disks is what allows higher densities to be achieved, but until now, one megabyte has been tops in the 3.5in format.

IBM has expressed great interest in the 3.5in technology, and many of the major software vendors are now producing their products on 3.5in diskettes. As anyone who has worked with them will tell you, they are far superior to the old 5in media, even without the higher densities.

Verbatim Australia is based in Artarmon, on (02) 437 6477.

HP offers affordable CAD plotters

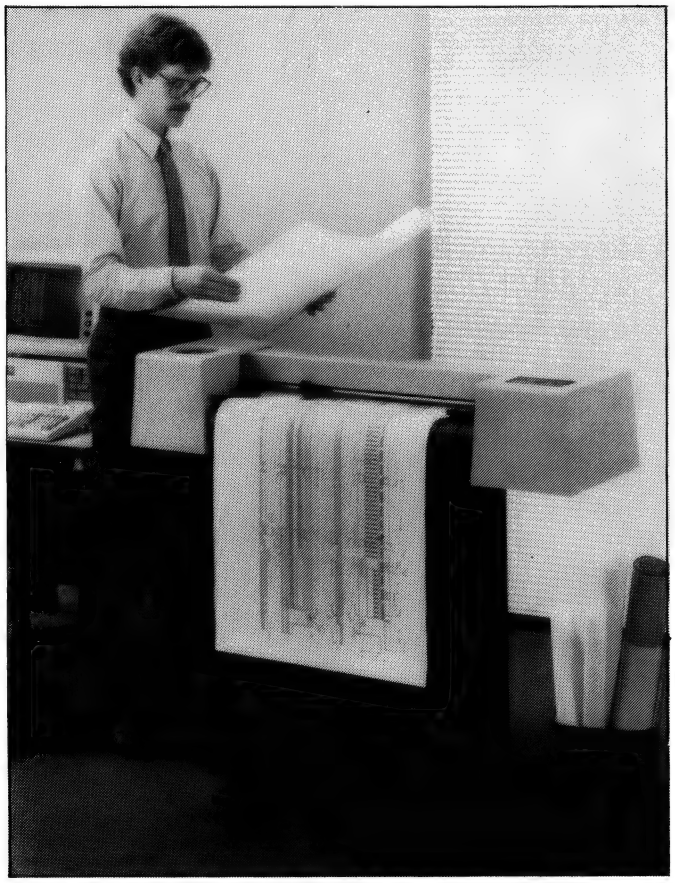
Hewlett Packard, often known as the Rolls Royce of the computer industry, and renowned for its range of high quality plotters, has announced a professional CAD-quality plotter at an affordable price.

The Draftpro plotter is aimed at the PC-CAD market, where users are reluctant to pay $20,000 for a plotter, but need something better than an A4 sized flat bed plotter. At a price of $8000, the Draftpro is quite a feasible acquisition for small architecture or engineering firms.

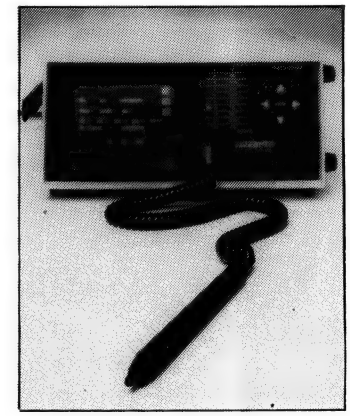
Price savings have been achieved through injection moulding and VLSI electronics, which has reduced the overall parts count (also making fewer things to go wrong). Due to its inherent design, the Draftpro neither has, nor needs, mechanical or electronic adjustments.

The plotter easily deals with C/D and A1/A2 size paper, and can be driven from many popular software packages, including Autocad, Anvil-1000 and VersaCAD. The plotter features 0.0005in mechanical resolution and 0.2 per cent accuracy.

Clever bits within the plotter automatically handle 'pen sorting', which means that the plotter will draw as much as possible in the current colour before taking the time to change pens. Pen speed is 15in per second, with a maximum acceleration of 2g. The standard interface is RS232C, with an HP-IB option available.



Low cost datascope



Dataplex has announced the availability of its half-price full feature data analyser.

Named the Netscope, the analyser offers a fully interactive CRT-based interface including light pen and carry case. The CRT can display 1024 characters and operates via a simple menu-driven interface. System parameters are battery backed, and the Netscope can handle async, sync, X.25 and SDLC.

Weighing just 6kg, the Netscope is programmable using a state-driven language and can emulate CPU or terminal. Data may be displayed in hex, ASCII, EBCDIC or binary. After recording a stream of data, a replay function allows control leads to be displayed as a signal waveform, and a histogram display simplifies data analysis.

The Netscope is priced at $5,000, and is available from Dataplex on (03) 735 3333.

Intermec hand-held laser scanner

A hand-held laser bar code scanner, catchily dubbed the 1620, has been released by Intermec.

Looking like something Luke Skywalker would use to scan bar codes, the 1620 uses a helium neon laser which is not sufficiently powerful to disable low earth orbit satellites. The scanner can handle bars as narrow as 0.0075in, or as wide as 0.1in, and can scan a strip as long as 7in. The scanner may be held up to 23in from the target.

The 1620 can be used with an Intermec laser reader, or with any of the Intermec 'wand' readers. A scanning rate of 36 scans per second means that accurate results are easily obtained.

More information is available from Intermec, on (03) 221 9788.

Paradise EGA from SCA

The new EGA display adaptor card for IBM PCs and compatibles is the way of the future. At last, a display adaptor is available which not only provides decent graphics, but also operates acceptably in text mode.

SCA has released the Paradise Autoswitch EGA card, a compatible display adaptor at a lower price, and plan to aggressively market the new product over the next few months.

The Paradise EGA card uses VLSI technology to cram itself into a short slot,

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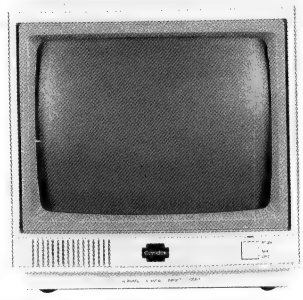

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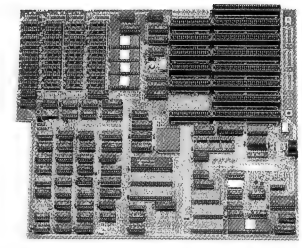
Δ 384K MULTIFUNCTION CARD.
Δ MONOCHROMEGRAPHICE PRINTER CARD (II)
Δ FLOPPY DISK DRIVE CONTROLLER(I)



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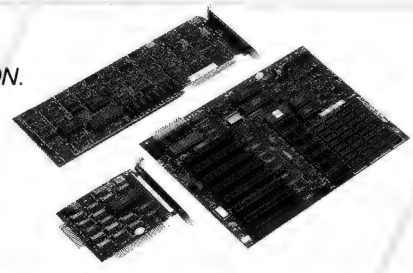

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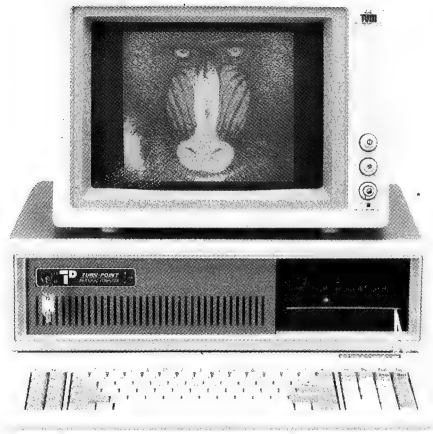

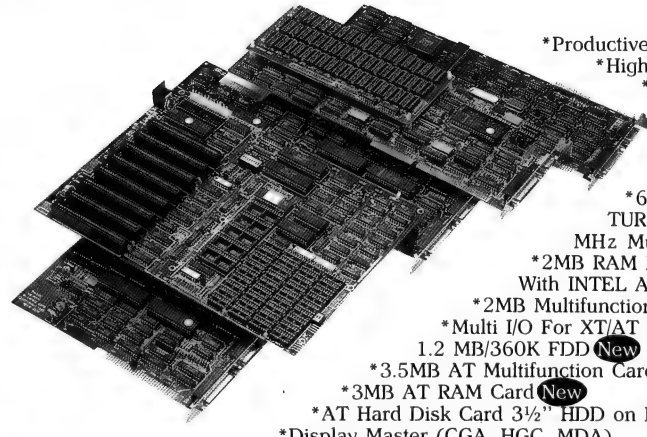

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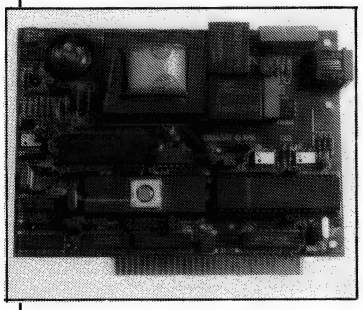
and can be used either standalone, or in conjunction with other display adaptor cards. The EGA board provides flicker free scrolling in all modes.

The unique feature, however, is the 'autoswitch'. This means that the card manages to be compatible with the EGA, CGA, Hercules and Plantronics boards without the need for mode commands. The card senses the type of software being run "using a form of artificial intelligence", and switches itself into the appropriate mode. Most software which runs on a variety of display adaptors senses which adaptor is currently in the machine by testing the various attributes of the various cards, and seeing which responses come back. It would be interesting to run the Paradise EGA card with some software which operates on all four emulation modes supported by the EGA. Perhaps the Paradise card would switch rapidly between its various display modes as the software tests each one. In other words, what happens when a display adaptor using a form of A.I. meets some software using a form of A.I?

The Paradise EGA card is priced at $895.00, and is available from SCA on (03) 699 7255.



Data Sat in and out modems

Data Sat Australasia has joined the highly competitive videotex and communications market with two modems and matched software.

The desktop modem handles both CCITT V21 and V23 and is interfaced to the computer via a standard RS-232C connection. The modem does not include a handset, as outgoing calls are made through the Hayes compatible auto-dialler. Similarly, incoming calls are picked up through the modem's auto-answer capability. For people with one phone line and friends who can't whistle ASCII, an optional handset connector is available.

The card modem offers all the facilities of the desktop modem, but plugs into an expansion slot of an IBM or compatible computer. Both modems include the VTX communications software which provides videotex communications for systems such as Telecom's Viatel. Additionally, the system can handle simple ASCII communications at 300 bps.

The desktop modem is priced at $575, and the in-board modem at $535, both inclusive of sales tax. Data Sat is on (02) 525 6888.

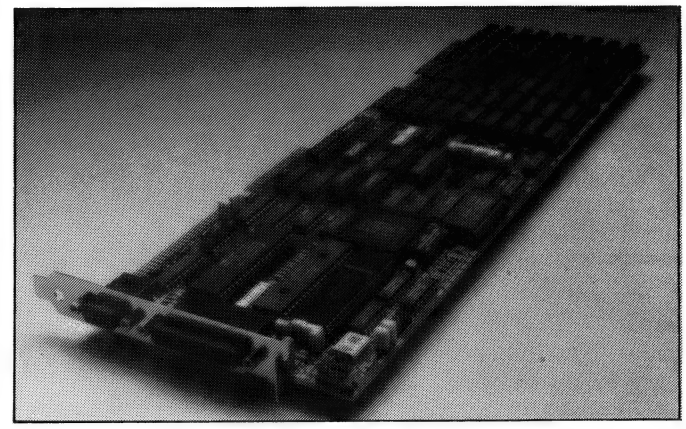
Emulex multi-function boards for PC

Emulex has announced two new combination boards for the IBM PC/AT: the Persyst Mono Combo/AT and the Persyst Colour Combo/AT.

The mono board includes a serial and parallel port, between 128k and 1.5Mb of RAM and a monochrome display adaptor. The Colour Combo offers much the same, but with a colour graphics adaptor.

Both boards are specifically designed to take advantage of the AT's 16-bit data bus, which means faster access to the screen. Emulex say that the boards cost no more than any other AT expansion board, and thus users should consider that they're getting the display adaptor for free.

One particularly neat feature is that the RS-232C



ports may be configured either to accept true RS-232C voltage levels, or to make do with TTL levels, an incorrect adaptation of the standard, but one which many low-end machines and peripherals seem to generate.

In a time when the EGA is clearly the way of the future, the Emulex colour graphics adaptor is only CGA compatible. But then, it's free.

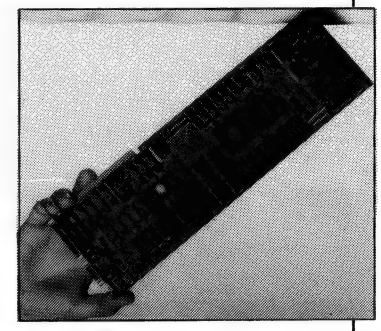
Emulex is on (02) 858 4833.

Australian PC performance booster

Australian manufacturer Hypertec has announced a new add-on board for the IBM PC and compatibles.

Hypervid, combines a video board and multi-function board on the same card. Priced at $1450, the Hypervid supports the EGA standard 640 × 350 resolution, the old CGA standard 320 × 200, plus the monochrome standards.

Included are 256k of video memory, 512k of system RAM, one Centronics parallel port, two serial ports and a clock/calendar. Bundled software provides print spooling, RAM disks and disk cache. As Hypervid is manufactured locally, Hypertec claims to provide better support than its overseas rivals, as well as being cheaper.



More information is available from Hypertec on (02) 819 7222.

Corvus networks with Novell

Corvus has dramatically reduced the cost of networking with Novell on its Trimline Combo 20Mb storage system.

The cost of the transporter card, which connects individual PCs to the network, has been dropped from $969 to $499. The Trimline Combo disk system has also been reduced to $3900, in an effort to make networking more affordable for the small business.

Another storage system, the Omniserver Professional, offers larger scale networking capability. The system includes an 80286 processor running at 8Mhz, and may be equipped with 40, 60 or 120Mb disks,

plus a 1.25Mb floppy drive. A 60Mb tape backup unit is included and the system can serve up to 60 user machines. If necessary, multiple hard disks can be installed in the server, or multiple servers can be run in the network.

Although the Omniserver is supposed to be a standalone network server machine, the box is also fully AT compatible, and can be used as a workstation in smaller networks. The Omniserver costs $18,000.

More information is available from Horizon Technology (previously Horizon Computer Corp) on (02) 498 6611.

Sourceware expands with Bernoulli

Sourceware has expanded its range of IBM PC and Apple hardware add-ons with the Bernoulli Box family of mass storage subsystems and the full line of Quadram enhancements.

The Bernoulli Box offers up to 40Mb of disk storage for IBM PC and Apple Macintosh users, while Quadram is well known for their multifunction boards, colour monitors, graphics boards and system enhancements.

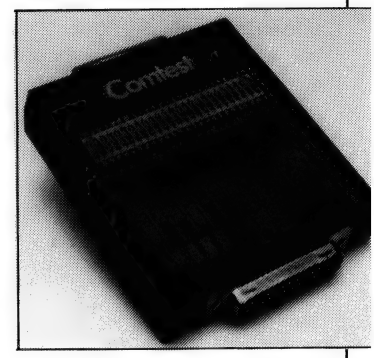
Sourceware is on (02) 411 5711.

All-in-1 breakout box

An "all-in-1" communications tester, or breakout box, now available in Australia features several unique facilities.

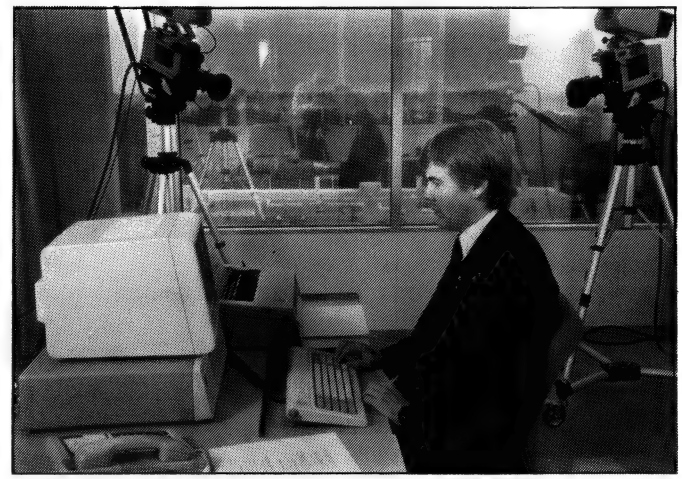
The Comtest fits neatly into the palm of the hand, and provides a 'tri-state' monitor of all 23 information pins in an RS-232/V24 interface. For the uninitiated, 'tri-state' means that it can indicate 'on', 'off', and 'no comment'. Switches on the unit allow all 25 lines to be broken, with the usual jumpers employed to redirect signals from one pin to another.

Unusually, the tester can provide a two level read-out of the open circuit voltage differential between the systems on either end of the cable. An open circuit differential can occur when the two pieces of equipment are running from powerlines with different ground potentials. Additionally, the unit can provide a four level indication of current loop power. The rear of the case is emblazoned with useful instructions and information.



The Comtest sells for $248, and is available from Motivation Plus, on (02) 707 1126.

Software



IBM puts users under the microscope

IBM has made a $1 million investment to assist the development of user-friendly computer systems.

The IBM Usability Laboratory, situated in Melbourne, offers customers the opportunity to test their software, installation, training, documentation or support in a controlled environment. Hapless users are exposed to the new system in a room equipped with cameras and microphones, so that their every grunt and curse can be recorded and later reviewed by the system designers. An adjoining room, used for monitoring, is equipped with terminals, controls and a one-way mirror.

IBM's first Usability Lab in Atlanta has found that 81% of all system flaws can be identified and corrected at the usability stage, resulting in large productivity savings when the finished system finally meets the users.

The Melbourne Labs' first customer was the National Australia Bank, which says the exercise has paid for itself many times over. More information is available from Jane Singleton on (02) 923 5302.

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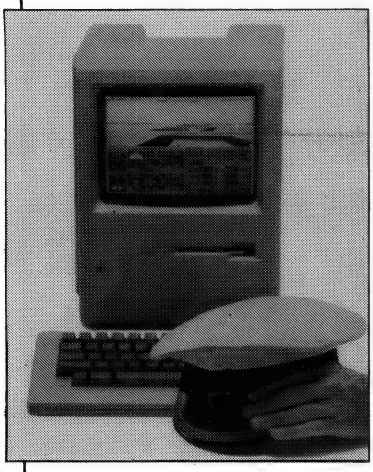


Macintosh Flight Simulator

Now this really is news. Flight Simulator, the well-known Sublogic entertainment software adopted by Microsoft, and responsible for many hours of executive time and one or two PC purchases, is now available for the Macintosh.

Including all the features of the IBM PC version, the Mac Flight Simulator also provides a Learjet mode. The topography maps 10,000 square miles to a resolution of 1/100inch, and includes 118 airports. Mac windowing allows the view displayed on the screen to either be from the cockpit, or from some external viewing point, or both at the same time.

All major flight functions are mouse driven, although the keyboard is still used for some menu options. An autopilot facility now lets busy executives get on with other things until a particularly interesting landmark is reached. An instant replay feature allows you to recall the last 75 seconds of flight, so you can show all your executive friends your latest clever manoeuvre.

Taking advantage of the Mac hardware, screen resolution on this version is significantly better than the old IBM release, offering much more realism.

Flight simulator must be one of the most impressive software products released in the last few years, and the Mac version certainly seems worth a look. At only $115, it seems like a bargain.

More information is available from your dealer, or from Microsoft on (02) 452 5088. *(See also 'Screenplay' elsewhere in this issue — Ed)*

New Lotus release

A maintenance release of Lotus 1-2-3 version 2 is now available from Imagineering.

Lotus 1-2-3 version 2 is not news in itself, but this maintenance release fixes a number of problems which version 2 users may have encountered.

In addition to offering greater compatibility with release 1A, the new version includes a simplified installation procedure, an extra display driver for graphics using the standard character set, and faster worksheet retrieval and recalculation.

Additionally, version 2 is now available for the Wang, DEC and HP machines.

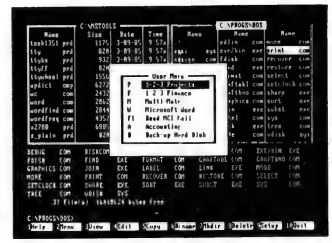
More information is available from Imagineering on (02) 622 4499.

Another one from Norton

Peter Norton, well-known author of the Norton Utilities and the book "Inside the IBM PC", has announced a third product, The Norton Commander.

Norton is renowned for producing good quality, high performance software, as many users of his utilities will testify. The Commander is a step further down toward the humble every day end user, who is less worried about recovering his FAT, and more concerned about fighting his way through DOS.

The Commander is a directory management system, a latecomer in an already teeming market, but probably stands to become a leader purely because it bears the name of Peter Norton.



The Commander takes over from DOS, giving the user a window full of all the files in his current directory. Alternatively, two windows can be used at the same time to make inter-directory file copying less fraught with difficulty. Files are selected for copying, deleting or browsing using 'point and shoot' technology, either from the keyboard or via a rodent. Directories can be created and removed, all from within the Commander.

Getting towards the Mac style of operation, software can be run simply by pointing at the name of the product. More interestingly, pointing at the name of a data file can automatically start up the appropriate product, although one wonders what it makes of the ubiquitous DAT file.

Microsoft communications software

When Microsoft does something, the whole industry sits up and takes notice. No doubt that's exactly what everyone will be doing with Microsoft's latest product, Access.

Access is communications software for IBM PCs and compatibles, and is distinctive in that it is one of the few communications products aimed at the end user, rather than the comms-aware computerist.

Now, I prefer using Crosstalk, and probably always will. It lets me do things like DEBUG ASCII, and fiddle with the word format while online, and generally get right into the whole scene. Crosstalk is a great tool when you're trying to get two machines to talk together, or access a new data source for the first time. However, for the average accountant or clerk, Crosstalk is like trying to get a little old lady from one side of town to the other by offering her a couple of pistons and a crankshaft.

Access, by way of comparison, aims right at the business people who have a need to do comms, but don't want to know anything about it. The same way Lotus 1-2-3 lets you fiddle about with numbers without knowing how IEEE standard floating decimals are stored.

Linda Graham, local MD of Microsoft says that Access will revolutionise the use of communications technology, and she is probably right. Access will herald the age of comms software which is as easy to use as a spreadsheet. Sure, Crosstalk is easy to use. Probably one of the easiest software packages to use you'll see in a long time, and it manages to be user friendly without being 'user-sticky'. However, Crosstalk is easy to use if you happen to know what duplex you should be in, how many data bits, stop bits and what parity you should be running. Access tries to hide all this.

Access views its world as a series of services. Microsoft provides standard service descriptions for the popular US services, and Microsoft Australia is busily churning out local counterparts. To use access, you simply point at the service you want, and off it goes. Once you're online, a series of Access menus act as a front-end to the normal facilities offered by the service. You don't need to know the command structure of the service in use, just navigate the Access

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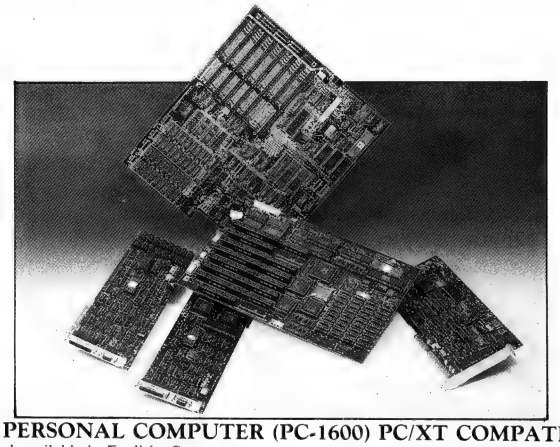

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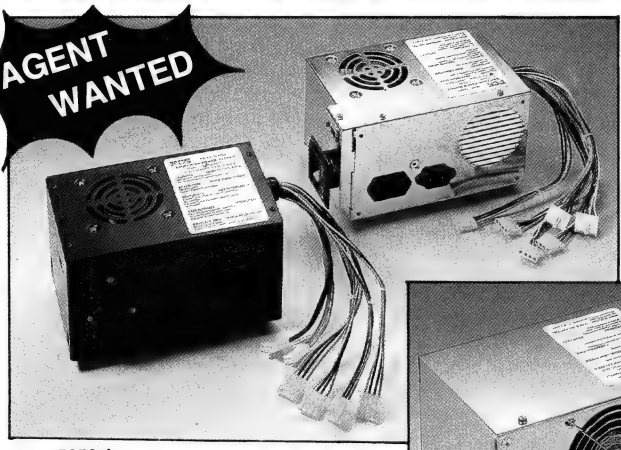

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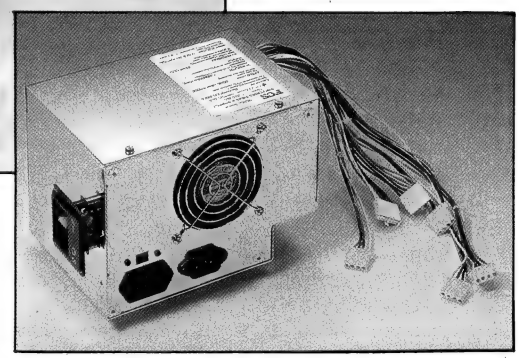

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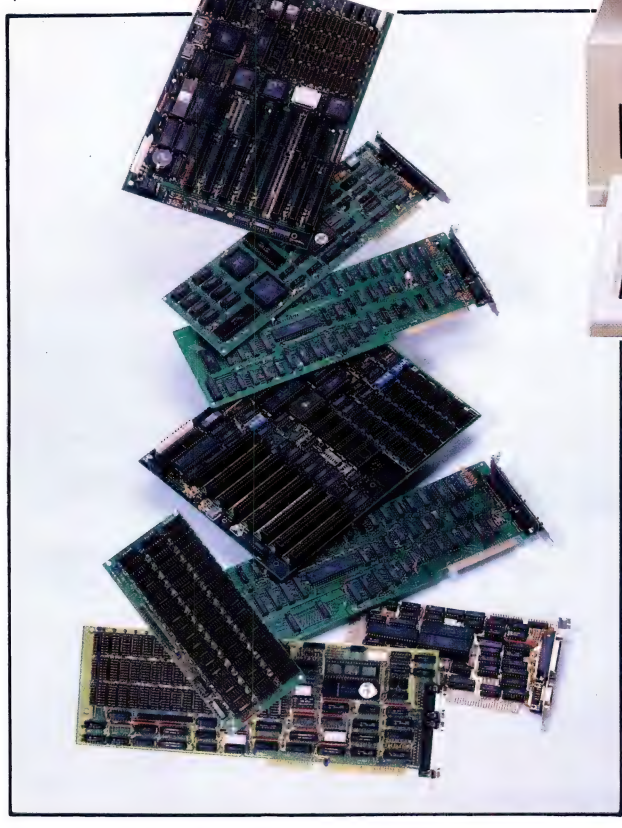

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- I/O Expansion Slot: 6 slot 98 pin, 2 slot 62 pin.
- Disk Drives: 1.2MB FDD & 20MB HDD standard (30 / 40MB HDD Optional)
- Ports: One each of serial and parallel standard.
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menus. The menus, of course, can be user defined.

For special applications, Access provides a language similar to, but more powerful than the Crosstalk script facility, which allows log-on sequences and the like to be programmed in. Access also allows inter-PC file transfers, and can do something rather clever through its X.PC protocol, which allows a single modem to connect with up to 15 hosts simultaneously, although how this is done and whether it will work in Australia, I'm really not too sure.

Terminal emulation facilities include VT52 and VT100 modes. Unfortunately, no US software seems to provide Prestel emulation for connection with Viatel, presumably because Prestel went nowhere over there. This means that while Access won't be the answer to all your communications requirements, it certainly should cater for most.

Access runs in 256k on machines with DOS 2.0 or higher, and is recommended for retail sale at $425. Microsoft is on (02) 452 5088.

Samna goes multi-user

Samna Corporation, represented in Australia by Arcom Pacific, has announced new versions of its word processing and office automation software which now supports the IBM PC network, in addition to 3-Com and Novell. Samna feels that PC-Net offers the first real standard in networking, and had delayed the introduction of a networked product until such a standard existed.

Samna Word III includes advanced features such as support of IBM's DCA (Document Content Architecture), DISOSS, spelling correction, table of content generation, line drawing and footnotes.

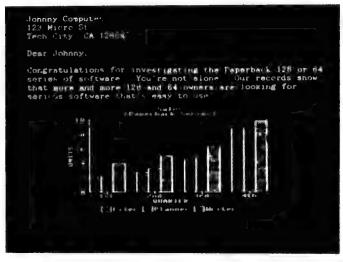
Samna Plus, the OA offering, includes not only the word processing facilities, but also an integrated spreadsheet and wordbase manager.

Prices start at $2000 for Samna Word III (requiring 320k), or $2500 for Samna Plus (requiring 512k), and increases according to the number of users on the network. Arcom Pacific is on (07) 52 9522.

Serious software for Commodore

Imagineering has announced the availability of some serious software for the Commodore 64 and 128.

Paperback Writer is a word processing system featuring on-screen italics, superscripts and subscripts, underlining, boldface and justification. In other words, what you see is what you get. The system includes a spelling checker with custom dictionary, 40 or 80 columns of text on the screen, 20 second fast load for 1541 and 1571 disk drives, linked files for large documents, user-definable characters and column manipulations.



The Paperback Planner is a 25,000 cell spreadsheet featuring automatic recalculation, 16 digit accuracy, global help, protected cells and locked rows or columns, an optional 80 character screen mode and word processing features. The data files are compatible with Visicalc, and include graphics.

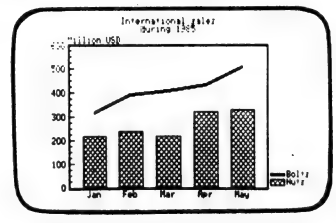
The third package, Paperback Database Manager, allows up to 255 fields per record with a maximum record size of 2000 bytes, up to nine sort levels, password protection with limited access, multiple column labels and on-screen help.

All three products are produced by the Canadian-based Digital Solutions, and all are a highly affordable $49.95. Imagineering is on (02) 662 4499.

Memory resident graphics

Memory resident software seems to be inexorably consuming everybody's RAM. A new memory resident package available from SCA provides unusual functionality, in that it manages to add graphics to any software package.

'Graph in the Box', produced by New England Software, runs happily alongside Lotus 1-2-3, Crosstalk, Multiplan, WordStar, Multimate and dBase III. Importantly, the mechanism for producing a graph is the same no matter what software you happen to be running. Simply hit the 'Alt G' key, and highlight the area of the screen you want graphed. Press enter, and hey presto, a graph.



Graph in the Box can produce column charts, stacked columns, bar, clustered bar, line, stacked line with filling, step, scatter and pie charts, and can even mix any six of the above into one chart. It can interface to a wide variety of plotters, including most of the HP range, and handles just about every printer under the sun. It can work with the IBM mono display adaptor, colour adaptor, EGA and Hercules, as well as a number of other third party boards. When running on a non-graphics adaptor, Graph in the Box constructs the charts out of normal characters.

Additionally, Graph in the Box can also read data directly from the keyboard or DIF files. It consumes 128k of memory, and normally sells for $195, but at the moment, SCA has a special introductory offer of $150. SCA is on (03) 699 7255.

Aussie menu system

A new Australian product which allows MS-DOS users to create their own menus has been released by Martlet Software.

Rather than being a development aid for programmers creating their own menu based software, Custom Menu allows everyday PC users to create a menu driven front end which simplifies the task of changing directories and starting up software products.

Custom Menu includes all those features that you'd crawl over broken glass to get in a menu system, including colour control, password protection for menu alteration, a date and time display, and a tree structured organisation.

Claimed by Martlet software to be significantly cheaper than the imported rivals, Custom Menu runs on IBM PCs and compatibles. Screen I/O can be selected to either run through standard MS-DOS calls (slow), or by directly addressing the screen. However, Martlet has not gone to the extra trouble of eliminating screen 'snow' in this mode.

Menu-based front ends are a questionable commodity at the best of times. Probably few people would purchase a menu front end for personal use,

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as having the knowledge required to install one implies also having the knowledge required to do without one. Nevertheless, many corporate users can make good use of these systems, and it's good to see more software being produced locally and marketed properly.

Custom Menu is currently available at a special introductory offer of $59.95, and includes a money back guarantee. Martlet software is on (03) 560 3851.

Monthly help for dBase users

dBase users know that the one thing they often need is technical assistance. In recognition of this fact, Ashton-Tate has introduced a series of monthly publications which offer assistance to users of Ashton Tate products.

Called "Tech Notes", and usually about 96 pages in length, the publication covers dBase II, dBase III Plus, Framework and Multimate. It contains usage tips, anomalies and reader letters. Each issue includes a special feature, and the June issue focuses on dBase III on the Novell network, as well as including an index for the last six issues.

Tech notes is available directly from Ashton-Tate in California, and costs $US75 for a 12 month subscription, which, in Australian dollars, well . . . a second mortgage should take care of it.

More information is available from Arcom Pacific, on (07) 52 9522.

Framework runs to a timetable

The popular Ashton-Tate system, Framework II, now has a time management product available. Dubbed "TimeFrame", the product provides an appointment book with six month or one month overviews and a calculator which can interface to Framework's spreadsheets, databases and word frames. Additionally, a contact directory, mail merger and 'Letter writer' are also included.

A tutorial helps users get off to a quick start. The product requires Framework II as a prerequisite, as well as 512k of RAM, and is priced at $79.95.

More information is available from the Ashton Tate distributor, ARCOM Pacific, on (07) 52 9522.

Remington goes for WYSIWYG

The Australian owned Remington has made tracks into WYSIWYG technology by integrating electronic publishing with office automation.

For the uninitiated, WYSIWYG stands for 'What You See Is What You Get', an important concept for productivity, as it means that the user does not have to obtain hard copy just to see what the finished product will look like. Instead, workstations are capable of high resolution displays showing exactly what will appear on paper.

According to marketing director, Alan Priestly, this combination causes the boundary between the two technologies to blur. The system involves NBI word processing workstations and PCs running NBI software, interfaces to laser printers capable of producing camera ready output. The IWS (Integrated WorkStation) software can be either function key driven, or run via a mouse.

The system includes a 90,000 word spelling checker, which can either verify as you type, or can verify an entire document after preparation. More information is available from Remington on (02) 269 0925.

Guiness Book of Records software

An Australian service provider on Viatel hopes to try for the Guiness Book of Records with its latest product.

The category will be 'Largest Computer Game in the World', but rather than being a 100 foot high space invader, the criterion for largeness is the number of simultaneous players.

Microtex 666, the largest service provider on Viatel, hopes that as many as 1000 players will join the record-breaking first game. Initial tests with only 40 players have been a success, and Microtex expects that it may be necessary to hold several hundred players over to the second game.

The game, called the 'Atlantis International Great Galactic Conflict', bears a loose resemblance to Diplomacy. The game is entirely based on skill and negotiating prowess, with moves being made twice a week. Special communications facilities have been created by Microtex to ensure player anonymity.

Microtex says they have one computer dedicated to managing the game running continuously 24 hours per day, with another computer brought in to assist for several hours on 'move days'. $5000 in prizes is being offered in a number of categories, with the grand prize going to the absolute master of the galaxy. Surprisingly, those who seem to score well in the GGC are not always the hard-headed businessmen one might expect. According to Microtex, the anonymity provided by the Viatel inteface helps to bring everyone to the same level, so the student can negotiate with the managing director, and the winner is determined by the better man, rather than who wears the pin stripe suit.

The Atlantis International Great Galactic Conflict starts on September 20. More information is available from Microtex on (03) 419 0666.

Windows Toolkit from Microsoft

Designed to aid programmers, the Windows Development Toolkit from Microsoft is a collection of utilities, debugging aids and sample source programs which should help develop Windows applications. To run the Development Toolkit, you must have Microsoft Windows on your system.

Included with the Toolkit are a utilities disk, three C library disks, a Pascal library disk, an include and program information disk, sample application disk, Windows programmers reference guide and stand-alone runtime disks.

To run the Developers Toolkit, you'll need an IBM XT or AT with at least 512k of RAM, a graphics adaptor, MS-DOS 2.0 or greater and a compiler.

The toolkit is priced at $500, and more information is available from Microsoft on (02) 452 5088.

Ask a silly question

Q&A, the 'ask a silly question . . .' natural language database system is doing so well that the local agents have decided to raise its price.

In a garbled communication from a PR company, it seems that Q&A is doing so well in Australia that it has sold more than 15,000

copies in the US. This makes it one of the best selling software packages in Australia. If you don't understand that, don't worry, neither do I. Seriously, Q&A should be doing well. Sperry is now bundling it with their PCs, and ACI has taken it on board.

Anyway, to celebrate, Symantec's local agent, International Solutions Australia, or Intelligence Australia (the PR company didn't seem too sure), has decided to raise the price.

What to?

That's a secret.

More information could be available on (02) 699 3877.

Expert systems in the hands of the users

ACI Computer Services' Scientific and Technical Division is distributing and supporting a new general purpose software package for building expert systems.

Using Rulemaster, engineers and other scientists can incorporate human-like decision making into their computer applications without having special AI skills. Rulemaster is a system of programs which allows the user to construct rule-based advisory or diagnostic aids, and was developed jointly by Radian Corporation and Intelligent Terminals Ltd, based on techniques originated at the Edinburgh University.

Most significantly, input to the system is in the form of examples, from which the software generates the rules. The system was designed this way because it is easier for human experts to come up with examples than generate cold facts and rules.

Rulemaster can either run interpretively, or can be compiled into C. This allows for fast development, and for the end product to be incorporated seamlessly into a final system.It is even possible to query the system with 'Why?' type questions.

The software is available under PC-DOS, Unix or VAX/VMS. More information is available from Bernhard Hengst on (03) 543 6166.

More moves from Borland

Never one to stand still, Borland International, producer of Turbo Pascal, Turbo Prolog, Turbo Lightning and Sidekick, and probably the hottest software company in 1986, has released three new products.

Lightning Word Wizard is a developers toolbox for Turbo Lightning. Borland has done very well with its other toolboxes, so it's not too surprising that it has made this move. The Word Wizard is for people who also have Turbo Lightning, and want to write software which makes use of the Lightning 'engine'. Borland constructed Lightning around this engine, and so its usefulness has been amply demonstrated. The engine provides ultra fast indexing, synonyms and file compaction. The toolbox includes 20 commented sample programs, four sample word games, one of which is a crossword solver. What's not too clear is whether you are able to access Lightning's word dictionary and, if so, whether you are able to extract all the words from it. Dictionaries are valuable things. The Word Wizard toolbox is not copy protected and sells for $120.

Borland has purchased the Singular Software company, which makes a relational database for the Mac, called Interlace. Borland plans to re-price, re-package, re-name and re-release the software as Reflex for the Mac. As you remember, Reflex was another of Borland's acquisitions. Interlace originally sold for $139, and was due to be hiked up to $195, but Borland will be selling it for just $US99.95.

Finally, Borland has announced a $A130 workshop for Reflex. The workshop includes a 250 page workbook and diskette with working examples. The examples cover the 20 most common database applications found in vertical markets. The idea is to get Reflex users up and running faster than if they were left to their own resources. Instructions show users how to construct their own system from the examples provided.

Borland International really is an interesting company. It makes one think that the real money in the PC market lies in selling software tools to all the people who are trying to make money out of the PC market, but won't. It could be right.

More information is available from Borland's local agent, Arcom Pacific, on (07) 52 9522.

New integrated application package

A new integrated application system is being distributed within Australia.

Named "Able One", and created by the Colorado-based Able International, the system encompasses every aspect of PC usage. It provides word processing, spreadsheet and database facilities, as well as graphics and communications. The software is window-based, which allows all five functions to be combined on the one screen. The system is also said to make use of 'artificial intelligence', through which it is able to have several files open at the one time. What will they think of next?

What really sets this product apart from the others, however, is its multitasking capability. While it's not too clear from the blurb exactly what level of multitasking is provided, at a minimum it seems possible to print to two different printers while also carrying out some other task at the same time.

The system is being distributed in Australia by Micro Imports, and sells for $199, with (we assume optional) annual support charge of $150. It requires a PC or compatible with 512k of RAM.

Micro Imports is on (02) 543 1544.

'It doesn't respond to my literary allusions anymore'

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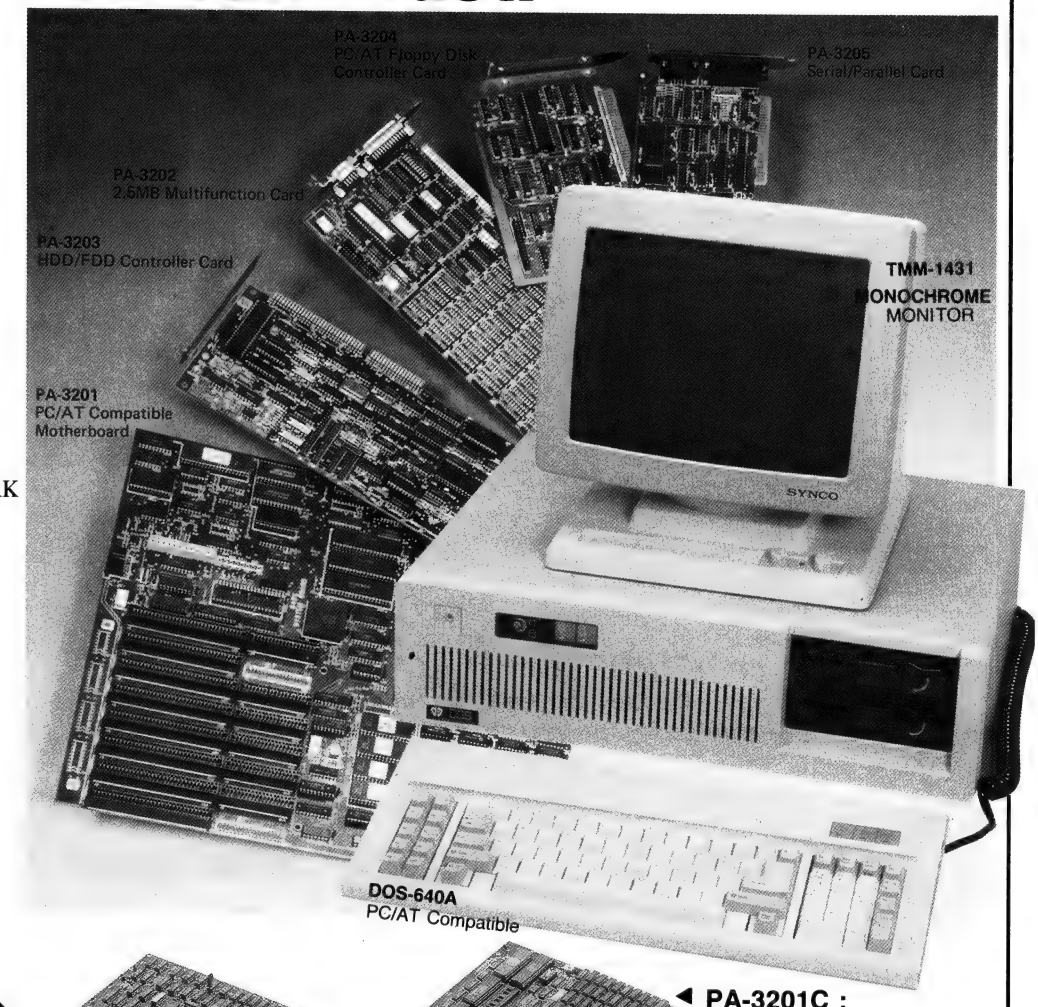
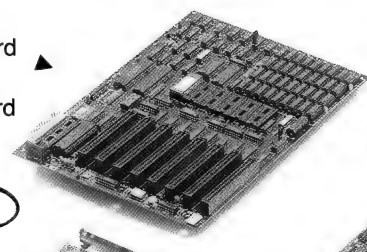


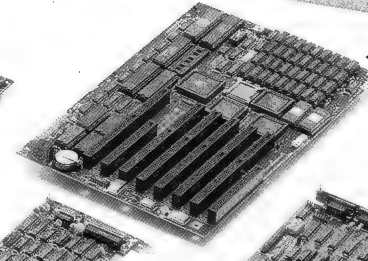
DOS-640A PC/AT Compatible:
DOS-640A PC/AT compatible can operate DOS 3.0, DOS 3.1, XENIX and most of the software for the PC-XT, such as Lotus 1-2-3, dBASE II, III; FRAMEWORK can also run on the DOS-640

AND ALL KINDS OF ADD-ON CARDS FOR PC/XT/AT

***NEW* ITEMS:**

PA-640A2 : (4 Layer)
10M Turbo XT Main Board
PA-640B2 : (2 Layer)
10M Turbo XT Main Board

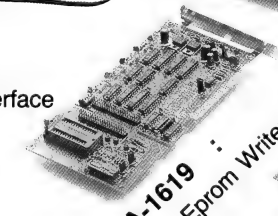




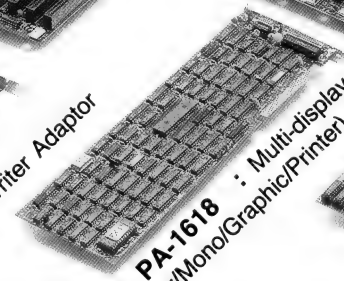
PA-3201C :
6/10 MHz AT Main Board.

BD-8610
Supports RS-232
Communication Interface
BD-8620
IBM PC/XT
Keyboard Emulator

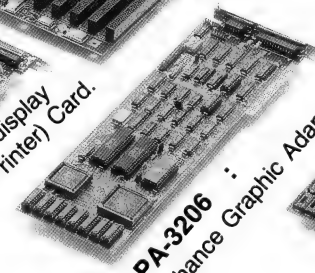
Bar Code Reader



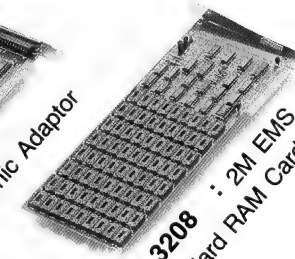
PA-1619 : Eprom Writer Adaptor



PA-1618 : Multi-display (Color/Mono/Graphic/Printer) Card.



PA-3206 : Enchance Graphic Adaptor



PA-3208 : 2M EMS Standard RAM Card.

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Taiwan is well known as a source of accurate clones available at a very low price. Many consumers on a budget send a mail order, or stop off in Taiwan on the way to some international destination to pick up an entire system. Others become agents for Taiwanese manufacturers. This special feature looks at the latest products to come out of the land of the rising clone.

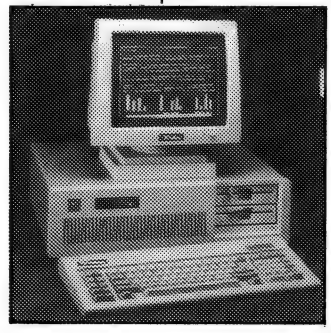
Winfortune AT compatible

The Winton 286 System AT compatible computer is one of the most successful products to come from Winfortune.

The computer is an 80286 based machine which provides full compatibility with the IBM AT and can run DOS 3.x. Currently, Winfortune is mainly selling this product in South-East Asia and Europe, but the company's aggressive marketing style means that it is keen to open up new markets.

Winfortune is an R&D and marketing company which places a great deal of emphasis on customer support. It is currently looking for an Australian distributor, and could offer a great deal of marketing support to its local agent.

Winfortune Enterprise has been in the game for a number of years, and is located at 3F-3, No. 125, Sec. 3, Roosevelt Rd, 10762 in Taipei.



Jointek AT from Giming Computer

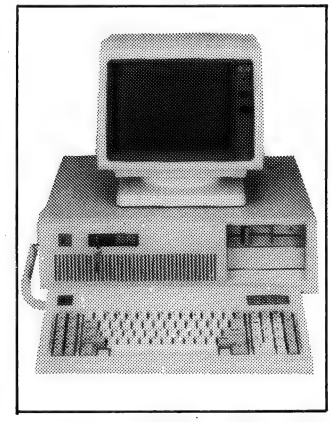
The Giming Computer Co. manufactures an IBM AT compatible which is available in several configurations.

The machine comes in a 'fair-dinkum' AT case with 84 key AT keyboard. A full megabyte of memory comes standard with the machine, as does an operations manual and 200 watt power supply.

Several choices are available to the buyer, including one or two 360kb or 1.2mb floppy disk drives and a choice of 10mb or 20mb hard disk drives which are available either in XT style speed 80ms average seek time, or the 40ms average seek time more similar to the AT. These storage devices are interfaced through a combined FDD and HDD controller card.

There is also a choice between a monochrome display and adaptor, or an EGA adaptor and matching colour monitor.

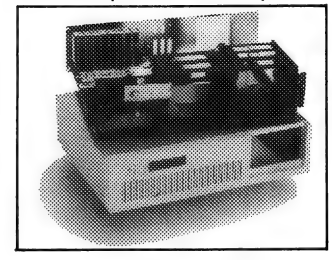
Giming Computer is located at 5F, #139 Nan Kang Rd, Sec 3, Taipei.



For the handyman on a budget

In the do-it-yourself department, no system builder should be without one of these.

Ling Yin Corp. provides true AT and XT style cabinets which you can fill with the other products mentioned elsewhere in this section. Ying Yin is the largest cabinet manufacturer in Taiwan, using automated assembly lines which pro-



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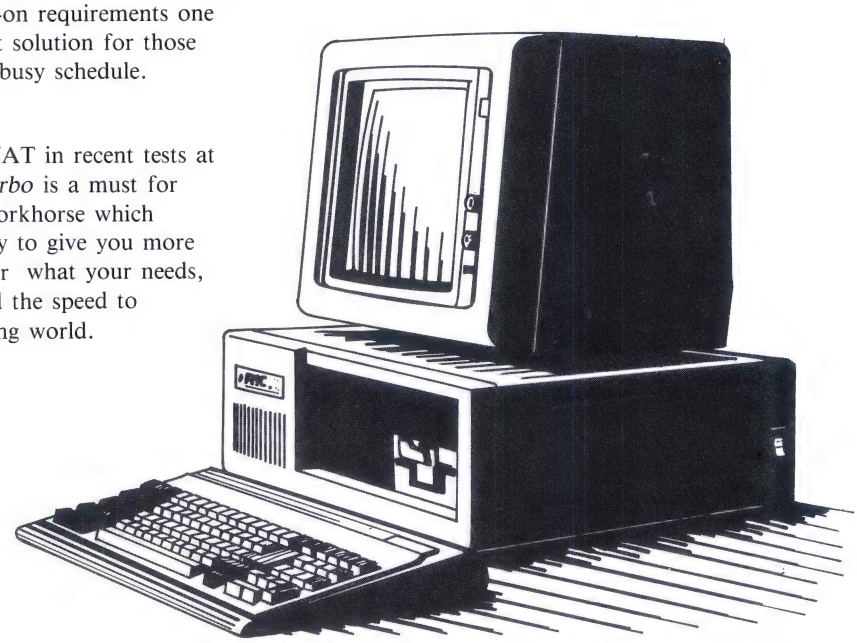
Actually, ARC offers a number of excellent solutions to satisfy your individual computing needs. Each has its own special advantages to help you keep up with an increasingly competitive world. For reliability, service and support you can trust, discover an ARC Solution - we guarantee it will be the best thing you've found.

ARC *Turbo*

The world's first *Turbo* PC is compatible with the IBM* PC/XT, and provides plenty of memory plus two speed modes to allow quicker access to all the most popular software. Also included is our 7-Plus Card which provides the most essential add-on requirements one needs to run a computer well. It is the best solution for those who need computer power to cope with a busy schedule.

ARC 286 *Turbo*

The system that outscored the IBM* PC/AT in recent tests at Arizona State University, the ARC 286 *Turbo* is a must for decision makers and problem solvers. A workhorse which combines the best in Advanced Technology to give you more of what you buy a computer for. No matter what your needs, the ARC 286 *Turbo* has the technology and the speed to keep you in touch with today's ever-changing world.



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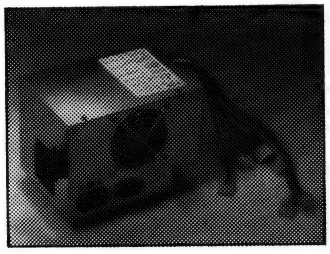
duce thousands of cabinets each month.

Ling Yin can provide a choice of 20 bezels (badges) to adorn the front of the case, and if it can't do an IBM badge, well, you could always prise one of the XT at work. Doubtless many of the clones following from Taiwan are housed in Ling Yin cabinets.

Ling Yin is at 9F-3, 57 Fu Hsing Rd, Taipei.

High quality switching power supply

Having obtained a cabinet for your new computer, the next step is to insert a few herbs. This switching power supply from Supterment Enterprises can be used in both XT and AT configurations, and can be sourced from either 115 or 230 volts.



It includes over load and short circuit protection with low noise and ripple on the output. When power is cut off, the unit takes over 20ms until supply to the computer is interrupted. To take advantage of this, a 'power good' signal can give warning of the impending outage. The power supply meets all FCC requirements.

Supterment Enterprises can be reached via P.O. Box 68-2297 Taipei.

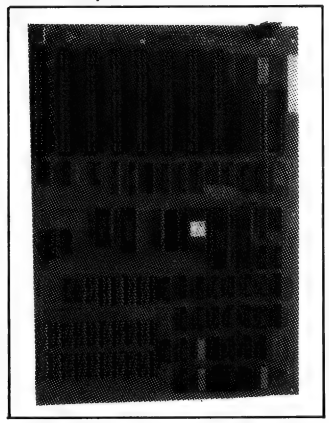
XT motherboard

Okay, you've got a cabinet and a power supply. The next item on your shopping list should be a motherboard. XT or AT? — just choose one of the following.

Datatech can supply you with a PC/XT style motherboard to get your system off to a flying start. The board contains an 8088 CPU and optional 8087 numeric coprocessor running at either 10 or 4.77Mhz. Selection between the two speeds may be done either by software or hardware, but most users would keep the switch firmly in the 10Mhz position, except for the occasional arcade game.

Memory can be expanded to 640kb without the need for additional boards, and the product comes complete with an 8k BIOS ROM, legally produced by ERSO. Eight expansion slots are provided and 4 channel DMA running at 5Mhz. The board is fully IBM PC and XT compatible, and forms the starting point for a complete computer system.

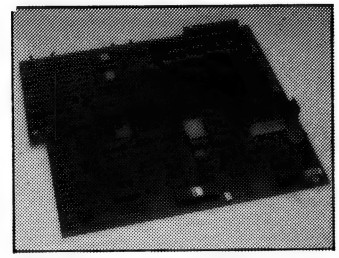
Form a queue for Datatech Enterprises at P.O. Box 96-361 Taipei.



One-stop AT motherboard and EGA

Autocomputer Co. can supply you with both an AT motherboard and an EGA card.

The motherboard runs an Intel 80286 at 6Mhz, which can be upgraded to 8Mhz, and comes complete with 640k of RAM, although the motherboard can support a maximum of 1mb. Using expansion slots, up to 16mb can be added to the system. Eight expansion slots are provided, two of which are the PC/XT style 62-pin eight bit slots. A socket is included for a backup battery, and a manual is available.



The EGA card provides support of the IBM EGA, monochrome, colour graphics and Hercules monochrome text cards. It comes complete with 256k of graphics memory, and can provide resolutions of 720x350 in monochrome, or 640x350 in EGA mode.

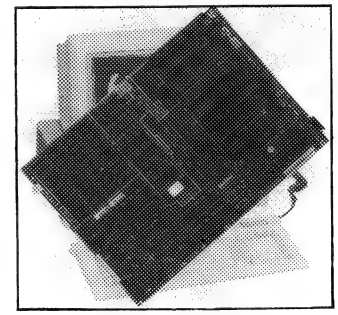
Autocomputer Co. is at 4F, No. 5, Alley 3, Lan Syh Wei, Chung Cheng Rd, Hsin Tien, Taipei.

X'Golden Board

An alternative XT or PC motherboard is the X'Golden Turbo Board. This product includes an 8088-2 running at 4.77Mhz which is capable of being upgraded to 8Mhz.

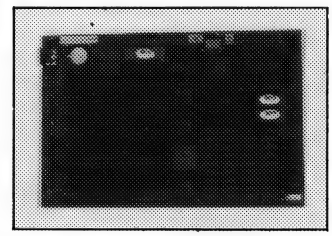
It is somewhat unique in that it offers a couple of AT-style features, namely a keyboard lock and a 'power-ok' LED. An 8087 co-processor may optionally be added to the board.

The board is produced by Turn-point Science Technique Co, which is at 11F-5, No. 80 Ho Ping West Rd, Sec 1, Taipei — just near the footy ground.



Soyo AT motherboard

If AT speed is more your style, the SY006 motherboard sports an Intel 80286 processor with a 7 channel DMA and 16 level interrupt. It is switch selectable between 6 and 8Mhz, and includes 128k of ROM and 512k of RAM, expandable to 1Mb on the board. A real time clock calendar is also standard, with battery backed CMOS RAM to maintain the time and date while the power is off.



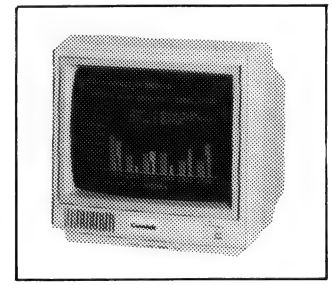
A speaker is included, as is a keyboard interface processor. The board is available in either 7 or 8 expansion slots configurations.

Soyo Technology Co. is based at P.O. Box 82-132, Taipei.

Colour monitors

The next item on the computer shopping list is a colour monitor. This could be a very attractive item even for people who are not keen on building up their own computers, because even though EGA cards are not too expensive here, EGA quality monitors most certainly are.

Comdek Corp. offers a range of three colour monitors. All are 14"



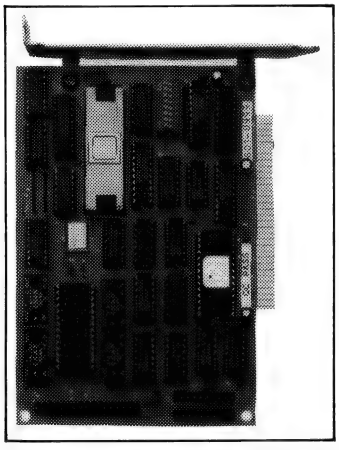
diagonal and have RGB interfaces. The three available are high resolution, medium resolution, and EGA quality.

Comdek Industrial Corporation can be reached through P.O. Box 30-115, Taipei.

Hard disk controller card

What's a computer without a disk?

This hard disk controller card from Hinet Industrial



offers full functionality and high performance in a half slot size. It uses the standard ST506/412 interface to drive either 3.5 or 5.25in winchester disks.

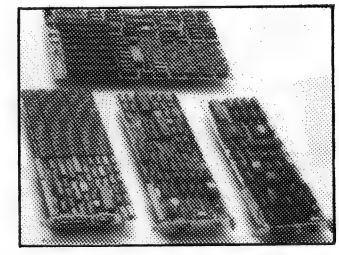
Up to two disks can be controlled from the board, and 16 DIP-switch selectable drive types may be used for either drive. The interleave factor is user selectable through EPROM resident firmware. CRC and ECC functions are built-in to provide automatic error-detection/error-correction.

Hinet Industrial can be reached through P.O. Box 84-510, Taipei.

Expansion cards

Utility International offers a range of products with which you can fill those gaping expansion slots in your PC, XT or AT clone or true-blue.

The EGA card provides 640x350 colour resolution and is completely compatible with the IBM EGA, GCA and MDA. For users who do not wish to go to the expense of an EGA standard monitor, Utility International can also provide a combined CGA and MDA compatible adaptor. For those memory hungry integrated application packages, a 2.5mb RAM



card can be added to your system.

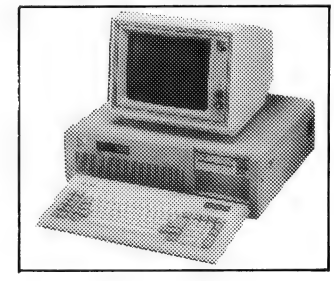
Utility International also produces mouse cards, motherboards, power supplies and disk controller cards.

You can contact Utility International at P.O. Box 30-344, Taipei.

PC-3200 AT compatible computer

For the less adventurous, P & C Shiten Enterprises can provide you with a complete AT compatible computer system.

As the name may not



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Monitors from $290.

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Budget W/P System

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Professional W/P System *

Based on the DSE Multitech personal computer, this system is perfect for the office, the school or the home. Includes the Multitech computer, DWP2500 printer, plus your choice of quality word processor software: "Easy", "Perfect Writer" or "Electric Pencil". And because the Multitech runs most IBM software, this system can be expanded as far as you want it to! Cat X-8009

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Just a computer?

Of course, if you're looking for the computer without any software... no problem! The DSE Multitech is available in several models with various options, starting at just $1395 for a single disk, 256K machine. Ask about the exciting new DSE Multitech computer models at your nearest DSE store now!

Cat X-8000

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Near letter-quality dot matrix — Dataproducts 8012

Speed, performance and versatility! The 8012 printer offers selectable print modes: draft, type or letter quality. Prints up to 180cps in 6 pitches with either bold, underline, super and sub-script characters. 10" carriage and popular Centronics interface. Cat X-3200

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For bigger jobs... Dataproducts 8022

The 8022 is the ideal choice for any busy office. Its large 15" carriage handles massive document work, printing at an impressive 180cps. And it can even emulate IBM graphics printer... operating with virtually any software. Cat X-3205

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Budget DaisyWheel

The DSE Datamate: 120cps print speed with variable pitch, top quality print and standard parallel interface means this one's perfect for the office, student, etc where presentation is really important. Cat X-3230

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suggest, the PC-3200 is an 80286 based machine with eight expansion slots, a socket for an 80287 numeric co-processor and real time clock calendar.

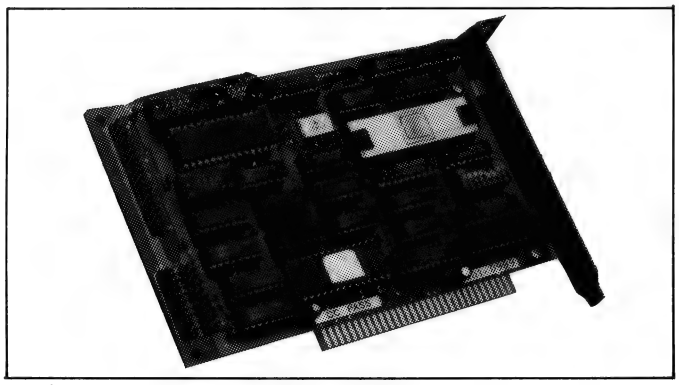
Options include 512kb, 640kb or 1mb of RAM, colour graphics/printer adaptor or monochrome/printer adaptor or high resolution colour graphics adaptor. The system comes standard with a combined floppy/hard disk controller card and AT keyboard.

P & C Shiten Enterprise Co. is headquartered at Room 7, 8th Floor of No. 100 Roosevelt Rd, Sec 3, Taipei.

HC-200 hard disk controller card

Sailing Strong International Co. produces a half size hard disk controller card, catchily dubbed the 'HC-100'.

This card can support two drives, possibly of different types, configured through a bank of eight DIP switches. The board is compatible with XT and AT style motherboards.

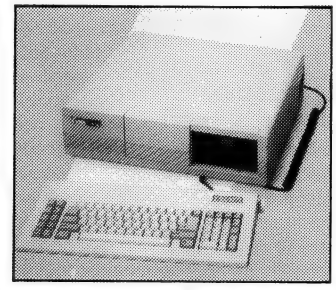


Sailing Strong International is based at 5-5F, 191 Fu Hsing North Rd, Taipei.

Flying Triumph FOX-16XT

Although it sounds more like some sort of traffic mishap, this company produces an XT compatible computer system.

The FOX-16XT runs an 8088 CPU at 4.77Mhz with a socket for an optional 8087 numeric co-processor. It provides 256kb of RAM as standard, and can be expanded to 640kb. The computer includes 48k of ROM, 8k of which is used for the BIOS.



Eight XT compatible expansion ports are included, as are dual 5.25" floppy disk drives. An optional 10mb winchester drive is available. The keyboard is a 98 key XT standard configuration.

Flying Triumph is at 118 Chung Hsiao East Rd, Sec 6, Taipei.

ARC Jet Turbo

Back with the AT compatibles, this machine runs an 80286 CPU at 8Mhz and is equipped with 640k of RAM, expandable to 1mb on the motherboard. Eight expansion slots are provided,

- Extremely easy to learn and use
- Data is interchangeable with all modules and other products
- Multiple Windows allow quick movement between tasks
- Four background, one foreground mode. Can print on two printers or plotters and two communication devices (modem and main-frame direct connection) all at the same time.
- Artificial Intelligence features reduce the number of keystrokes required to perform tasks
- Upgradable software and data to UNIX and XENIX
- Colourful graphic representations

- **Package contains:** one plastic box, one illustrated reference manual, one program disk, one sample diskette, keycaps and user support plan
- **System Requirements:** IBM PC or compatibles, 512K, two 360K diskette drives, color or mono display
- Hotline Support Available for 30 days.

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— Michael D. Bowe, DATA GENERAL

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— Robert Lawrence, ITT INFORMATION SYSTEMS

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as well as a 360kb floppy drive, which can optionally be replaced with a 1.2mb drive.

A standard AT keyboard is provided with the machine, as is a '4.5in' monochrome monitor, which comes complete with '7in magnifier'. The system is said to be compatible with all major software released for the IBM AT.

Plus & Plus Corp is at 2F, 126 Rossevelt Rd, Sec 3, Taipei.

Sun Up EPROM programmer

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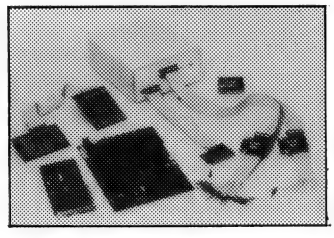

The EPROM programmer is available from Sun Up Computer Co, No 50, Lane 184, Yung Chi Rd, Taipei.

Prestico bar code reader

This bar code reader is available in two models, one provides a standard RS-232 interface which can be connected to any computer, and the other emulates an IBM PC keyboard.

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The reader is available from Prestico Associated Corporation, P.O. Box 7-559 Taipei, or drop in and see them at 9/F, No. 41-2, Sec 3, Shin Yi Rd, Taipei.

Simple arithmetic

Fixed-point arithmetic is a variation on integer arithmetic, and allows greater versatility in real-time calculations. Tony Armitstead guides you through the design of fixed-point algorithms.

Most users/programmers use floating-point arithmetic at some stage in their use of computers. This type of arithmetic is of great use in scientific applications and general day-to-day calculations. There are, however, problems associated with floating-point arithmetic, and it is when these problems arise that we may be forced to seek other means of performing the required calculations.

The kind of problems which usually arise are speed (that is, too slow), storage (usually four or eight bytes per floating-point variable) or implementation restrictions (for example, bit size of mantissa). The first two problems are usually easy to spot, with your program running too slowly or running out of storage space. The third problem can be very difficult to diagnose, with your program producing the wrong answer for no apparent reason. This often happens to businessmen when they acquire their first computer and produce a masterpiece of Basic to add up a column of figures, only to produce the wrong answer (try adding 7641.11 to 7641.11 on an 8-bit version of Microsoft's Basic interpreter — the answer returned is 15282.2!) This is not a bug in Basic, but a limitation of the Microsoft single-precision format of floating-point numbers.

Integer arithmetic

One alternative to floating-point is to use integer (whole number) arithmetic, which has speed and storage advantages, but on the face of it precludes the use of the fractional part of a real number. In fact, it is quite possible to include the fractional part of a real number with the whole (or integer) part, as long as we have prior knowledge of the magnitude and accuracy required. We can then store the number in integer format, and by interpreting it as a *fixed-point* number, we can use *fixed-point arithmetic* to achieve the answer (also in fixed-point format).

A quick and easy example will illustrate this point. Suppose we want to add 3.125 and 4.25 (to produce 7.375). In this example, we notice that both numbers can be scaled by 1000 to produce 3125 and 4250, which are both integers; thus we have included the fractional part with the whole or integer part. We can then add the two integers (using integer arithmetic) to produce 7375. This can be viewed as adding the fixed-point numbers as follows:

```
 3(.)125      3125
+4(.)250     +4250
---------->  ------
 7(.)375      7375
```

We then interpret the result as having a decimal point between the 7 and the 3 to produce 7.375. Notice how we must ensure that the decimal points are aligned before we can add the integers,

'This is how fixed-point arithmetic gets its name — we must fix the position of the decimal point and align the points before we add. We can then just remember where the point is...'

and how the result has the decimal point in the same place. This is how fixed-point arithmetic gets its name — we must fix the position of the decimal point and align the points before we add. We can then just remember where the point is, and treat the numbers as integers; the result has the point in the same place as the inputs. This operation is equivalent to choosing a scaling factor, by which we assume that all numbers will be scaled. We then operate on the scaled numbers and de-scale the answer. The above example chose 1000 as the scaling factor (we could have chosen 8 to produce 3.125*8=25 and 4.25*8=34, and then produced 25+34, and then produced 25+34 = 59, which we would de-scale to 59/8 = 7.375) so that we could get the 5 in 3.125 into the integer and clearly show the decimal point.

In most computer-orientated applications, we do not work in decimal points but in binary points. In this case, we would not choose a power of 10 as the scaling factor, but a power of two. The binary point is directly analogous to the decimal point. If we consider the base 10 number system, the first position after the point represents the 1/10ths, and the second the 1/100ths (=1/(10*10)), and so on. If we consider the base two number system (binary), the first position after the point represents 1/2, and the second 1/(2*2)=1/4, and so on. Therefore in binary, 1.5 = 1.1 and 3.125 = 11.001.

The scaling by a power of two will shift the binary point in the same way as scaling by a power of 10 shifts the decimal point. If we review the aforementioned example in binary, we have:

3.125 = 011.001 (in binary)
4.25 = 100.010 (in binary)
If we use eight as the scaling factor (8=2^3):
8*3.125 = 25 = 011001.0 (in binary)
8*4.25 = 34 = 100010.0 (in binary)

By comparing the bit patterns, we can see that we have just moved the binary point. We can then add the binary integers:

```
 011001       25
+100010      +34
--------->   ----
 111011       59
```

and remember where the binary point was (or de-scale) to produce 111.011 (in binary) = 7.375.

We now see that the *8 scaling factor has also produced fixed-point arithmetic, but this time in binary as opposed to decimal.

```
Inputs: dy , dx   - Both 16 bit integers in the ranges
                     0 <= dy <= 199 , 0 <= dx <= 639
                    with |dy/dx| <= 1.

Output: m         - A 32 bit integer representing 2^17*m
                    where m = dy/dx. The bottom 3 bits of
                    m are zero.

Start:

1. LET DY_32 = 2^14*dy      (32 bit integer)

2. LET M_16 = DY_32 div dx (to produce 16 bit integer)

3. LET M_32 = M_16          (Sign extend to a 32 bit
                             integer)
4. LET M_32 = M_32 << 3     (Shift 32 bit integer left 3
                             places)
5. RETURN M_32

End.
```

Fig 1 An algorithm to calculate gradient m

Fixed-point in use

To use fixed-point arithmetic, we have to choose a scaling factor suitable to our requirements. It is of prime importance to choose a correct scaling factor, or we run the risk of producing erroneous results. To determine the scaling factor we must take the following into account:

1 The range (magnitude) required by the inputs *and* the results;

2 The accuracy (smallest fractional part) required of the results — this determines the accuracy of the inputs; and

3 The type(s) of integer arithmetic available.

To deal with these points in turn:

(1) If, for example, we know that the result will be in the range 0 . . 255, then we will require eight bits to store the whole part. Likewise, if the result is in the range 0 . . 6345, then we will require 13 bits (in fact, 13 bits will cater for the range 0 . . 8191, but 12 bits only gives a range of 0 . . 4095). In general, for a range of 0 . . a, we can find the number of bits required from:

bit_count = int[log(a)/log(2)] + 1

If the range of numbers includes negative numbers, we have to add an extra bit to hold the sign information in the two's complement form. Thus, if the range is -200 . . 624, then we require 11 bits (10 bits for the 0 . . 1023 range and an extra bit for the sign). In general, for the range -a . . b (with a > 0, b > 0), the number of bits required is:

bit_count = int[log(max{a,b})/log(2)] + 2

If these bits cover the format of the result, we usually employ the same bit count for the inputs so that operations are simplified.

(2) If we know that the result must be accurate to 1/2, say, then we require one bit after the binary point. If the result must be accurate to 1/10, we require four bits after the point (this gives accuracy to 1/16, but three bits is only accurate to 1/8). Note that this defines the accuracy of the *result*. The accuracy of the inputs must be such that, after operating on them, we can achieve the result with its correct fraction. To illustrate this, suppose we have to achieve resolution to 1/2 in the answer by adding together two fixed-point numbers. To achieve this, the inputs must both be accurate to 1/4 — that is, the inputs must both have the second bit after the binary point correct. To further illustrate this, let a=1.01 (binary) and b=0.01, but suppose the last bit of 'a' is incorrect and should be 0! The result of a+b is 1.10, which has an error of 0.01 (it should be 1.01) and has (wrongly) affected the 1/2 bit.

(3) The type (signed or unsigned) and word length (8, 16 or 32-bit) of the integer arithmetic provided may affect our fixed-point format. If we are working with a 16-bit ALU processor (for example, 8088/8086, PDP-11 or AMD 29116), we may prefer the fixed-point format to occupy one word with any sign bit in bit 15. This may or may not be convenient, depending on the magnitude/accuracy required.

When we have chosen the scaling factor, we can perform integer operations on the numbers as required. It is vital that at all times, we know the position of the decimal/binary point. To help with this, it is usual to write down the calculations in algebraic terms, with the scaling factors, and deduce the scaling factor of the result. This is very easy for addition and subtraction.

Suppose we choose powers of 2 as

```
Inputs: x1,y1,x2,y2
        16 bit integers giving the coordinates of the
        two ends of the line with 0 <= x1,x2 <= 639 and
        0 <= y1,y2 <= 199.

Start:

   /* Optimize out the vertical/horizontal lines */
1. IF x1 = x2 THEN vline
2. ELSE if y1 = y2 THEN hline
3. ELSE
4.      IF abs(y2-y1) <= abs(x2-x1) THEN
            /* |m| <= 1 */
5.          IF x1 > x2 THEN swap the points
6.          LET x_16 = x1
7.          LET y_32 = y1 << 17
8.          LET p_count = x2 - x1 + 1
9.          LET m_32 = gradient( x2-x1 , y2-y1 )
10.         FOR loop = 1 TO p_count DO
11.             y_16 = ((y_32 >> 16) + 1) >> 1
12.             set_pel( x_16 , y_16 )
13.             y_32 = y_32 + m_32
14.     ELSE
            /* |m| > 1 */
15.         IF y1 > y2 THEN swap the points
16.         LET y_16 = y1
17.         LET x_32 = x1 << 17
18.         LET p_count = y2 - y1 + 1
19.         LET m_32 = gradient( y2-y1 , x2-x1 )
20.         FOR loop = 1 TO p_count DO
21.             x_16 = ((x_32 >> 16) + 1) >> 1
22.             set_pel( x_16 , y_16 )
23.             x_32 = x_32 + m_32

End:

Notes: Variables ending in _16 are 16 bit integers.
       Variables ending in _32 are 32 bit integers.
       The left shift and right shift operators <<, >> are
       logical in that they zero fill.
       The set_pel routine lights up the pixel at the
       passed x,y coordinate.
```

Fig 2 An algorithm for line drawing

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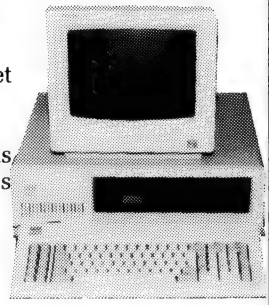

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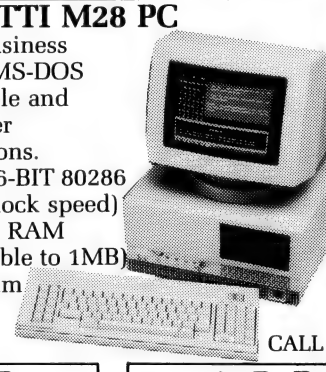

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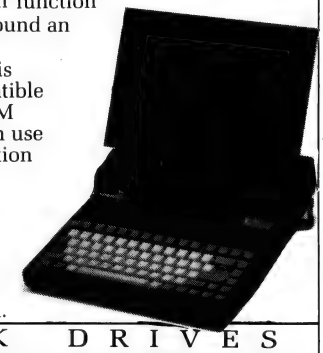

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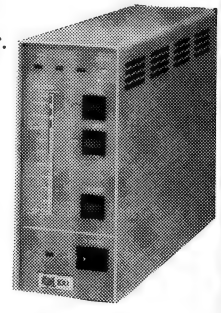

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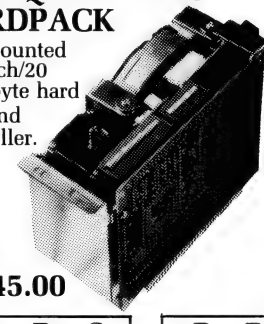

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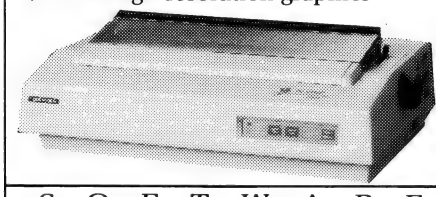

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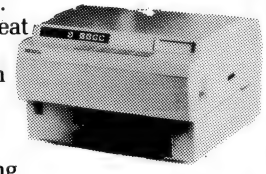

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```
/*************************************************************************/
/*                                                                       */
/* This is used to draw a line between 2 points on the screen. The       */
/* start and end point are passed as parameters. If the line is          */
/* vertical or horizontal then  hline() or vline() are used.             */
/*                                                                       */
/*************************************************************************/

/***********************************
/
/ uses a local version of abs()
/
***********************************/

static int abs( num )
int num;
    {
    if ( num < 0 ) return (-num);
    else return (num);
    }

/***********************************
/
/   This routine calculates dy/dx where dy, dx are signed 16 bit numbers
/   with dy <= dx. It returns a 32 bit result with format <15>.<17> i.e.
/   it has been scaled by 2^17. The result is passed back as a long integer
/   in DX:AX. Note the scaling gives bit 0 of DX = 0.5 so that rounding
/   is easy.
/
***********************************/

static long gradient( dx , dy )
int dx,dy;
        {
#asm
        SUB     AX,AX
        MOV     DX,[BP+6]           ; DX = dy ==> DX:AX = 2^16*dy/dx
        SAR     DX,1
        RCR     AX,1                ; DX:AX = 2^15*dy
        SAR     DX,1
        RCR     AX,1                ; DX:AX = 2^14*dy = <18>.<14>
        MOV     BX,[BP+4]           ; BX = dx
        IDIV    BX                  ; AX = <2>.<14> = 2^14*dy/dx
        CWD                         ; DX:AX = 2^14*dy/dx <18>.<14>
        SHL     AX,1
        RCL     DX,1        ; DX:AX = 2^15*dy/dx
        SHL     AX,1
        RCL     DX,1        ; DX:AX = 2^16*dy/dx
        SHL     AX,1
        RCL     DX,1                ; DX:AX = 2^17*dy/dx <15>.<17>
#endasm
        )

/***********************************
/
/    This is the main function for drawing a line between
/    two points. It closely follows the algorithm described
/    in Figure 2.
/
***********************************/

void line(x1,y1,x2,y2)
int  x1,y1,x2,y2;

    {
    /* These variables MUST BE STATIC for the assembler */
    static int x,y ;    /* The (x,y) point to plot */
    static int hi,lo;   /* The 32 bit value for x/y accumulation */
    static int points; /* The number of points to plot */
    static long m;      /* The gradient 2^17*m */

    if ( x1==x2 ) vline(x1,y1,y2);
    else if ( y1==y2 ) hline(y1,x1,x2);
    else
        {
        /* We have to use different methods depending on the gradient
           of the line.                                               */

        if ( abs(y2-y1) <= abs(x2-x1) )
            {
            /* The line has |gradient| < 1 so we use y=mx+c. */
            /* So that x increments we order the points so that
```

Fig 3 Listing of line procedure (continued on page)

the scaling factor, and wish to add/subtract two such numbers. If the scaling factors are the same, we simply add/subtract the fixed-point forms to produce an answer in the same fixed-point form:

$a*2^8 + b*2^8 = (a+b)*2^8$

$a*2^8 - b*2^8 = (a-b)*2^8$

If the scaling factors are not the same, we *must* make them the same before adding. This would involve further scaling of one of the inputs before addition/subtraction.

If we wish to multiply two fixed-point forms, we do not have to force both inputs to have the same scaling factor, but the scaling factor of the result is the sum of the two input scaling factors' exponents:

$(a*2^8) * (b*2^4) = (a*b)*2^{12}$

We may then require a de-scaling of the result into a required output form. When using integer multiples, we must take care that integer overflow does not occur — the answer lies in the range of the output integer (some processors always return a 32-bit integer result from the product of two 16-bit integers, so that overflow cannot occur).

If we wish to divide two fixed point forms, then again we do not have to have the same scaling factor, but we must take great care to analyse the output scaling factor, as this time we subtract the exponents:

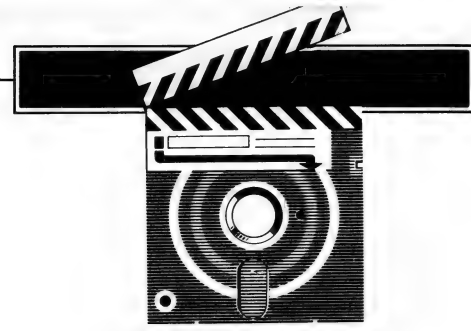
$(a*2^8) / (b*2^4) = (a/b)*2^4$

In order to get a larger-result scaling factor (and, consequently, a more accurate answer) we can (if possible) increase the scaling factor of the numerator of the division. This can be very processor-dependent (some processors allow a 32-bit integer to be divided by a 16-bit integer to produce a 16-bit result).

In order to demonstrate the above points, we will now develop a real-world application using fixed-point techniques. The problem is to devise a procedure to draw a line between two points on the IBM PC's 640X200 pixel display. This type of application is ideally suited to fixed-point techniques, since a floating-point implementation is far too slow (unless you happen to have an 8087) for practical applications. There are algorithms available for line-drawing which only use integer arithmetic (the famous Bresenham algorithm, for example), but the procedure given below, while having a slightly longer start-up time, has a similar point-to-point calculation time (taking seven assembler instructions to move from one point to the next).

To start, we must form a more concrete idea of the problem in hand. To define the problem, we must look closely

Goto page 185



SCREENTEST

Homebase

Homebase is a co-resident, multi-function utility program which provides a set of useful, pop-up 'housekeeping' menus for PCs. Simon Williams tests its organisational abilities.

The idea of a co-resident 'do-it-all' suite which sits in your PC until called is not new: the best-known name is probably Sidekick, which was released over a year ago. Time moves on, though, and most software gets bigger and better. Homebase, from American-based Amber Systems, tries to do just that. Where Sidekick offers a handy onscreen calculator, Homebase gives you 26 variables and a formula evaluator. Where Sidekick can hold notes and memos, Homebase has a structured database in which you can define a pre-set record, or enter 'freeform' notes. In addition it has a calendar, a terminal emulator, and a DOS interface.

As you might imagine with all this going on, Homebase isn't small. It's loaded from two disks, the second of which has to remain in drive B of a floppy-based PC while you're running it. In fact it takes about 135k of RAM, plus a full disk for overlays and data files. Hard disk installation is rather easier, and space is not then much of a problem, but you'd be advised to have about 512k of RAM if you're running anything substantial alongside Homebase. For all this, though, it sits out of the way until called from within an application by pressing '[Alt][Shift]H'.

The first Homebase display consists of a horizontal menu and a window showing the main Homebase options: calculator, calendar, DOS services, editor, notebase, quick-term and cut. You can move around Homebase menus with the cursor keys and select with [RETURN], or plug in a mouse to point and click. The main functions in Homebase can also be selected directly from an application program by using [Alt][Shift] sequences.

Each menu within Homebase is a line of options along the top row of the screen, with one highlight. The line below the menu gives brief details of the highlighted function, and changes as you move along the menu. This, coupled with copious help files, means you don't often need to refer to the manual.

The calculator

When the calculator is selected, Homebase displays three windows. These provide a list of variables and their contents, a 'tape' of the last 13 entries and results, and an entry window where your calculations appear.

The calculator has two modes: calculator and adding machine. In adding machine mode, each number you type in is added to the current total on pressing [Return]. The sequence of numbers scrolls up the 'tape' window and the total is displayed in a small window at the bottom. It's all very easy to use, and Amber is right in thinking that a lot of people use calculators mainly for addition.

For those who don't, the calculator mode supports the four arithmetic operators and exponentiation. You can type in a calculation as you would write it, and the result appears in the 'total' window on pressing [Return]. Alternatively, you can set any of the 26 variables and use them in your calculations. The variables are really 'memories' and only hold numeric results. You can't, for instance, assign variable C to be A/B and then feed in different values for A or B.

The calculator also provides a hex-to-decimal converter, and can print the results of calculations. Sidekick and GEM both offer a calculator accessory which is displayed like a calculator, and with the same functions. Homebase's doesn't try to maintain its links with a physical device, but does offer more facilities. Which approach you prefer will largely depend on your needs.

The calendar

This is really several calendars. It can show you a monthly or weekly table and a daily diary. An entry in the diary can be set to give an alarm, and these alarms interrupt any application to display your pre-set message and bleep at you. Before any of this works, though, you have to set the current date and time when you boot Homebase, or run a program such as Timer, if you have a battery-backed clock in your PC.

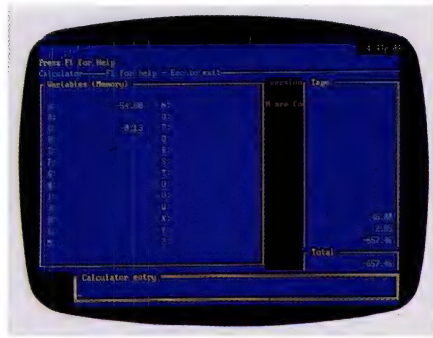
The monthly calendar displays a single month at a time, and highlights the current day and date. You can flick through the display by day, month or year, using the cursor keys and [Pg Up] and [Pg Dn]. Pressing [Return] on any day switches to the diary display for that day.

The weekly calendar shows the seven days of the current week and highlights the times of any appointments set. The current day is framed. Again you can switch straight into the diary display.

The diary is the main part of the calendar function, and allows you to insert and delete appointments or other notes for any time of the day, together with expenses you might charge — a comforting thought.

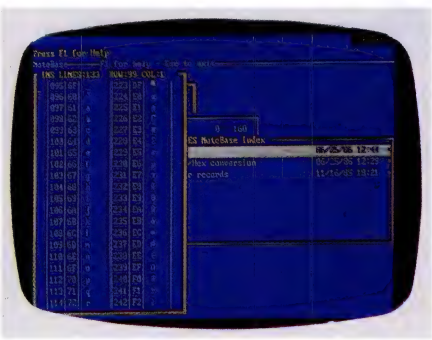
Along with the appointments display is a 'To Do' list, and you can tab between the two windows. The To Do list, as its name implies, can be used to remind you of tasks which, while not tied to a

The Homebase main menu



Three base calculator

Comprehensive DOS services



ASCII conversion table

The Homebase calendar

Text editor screen

particular time of the day, still have to be done.

An interesting feature of the calendar, which ties into the Notebase 'core' of Homebase, is the Find option. If you want to display an appointment, but are not sure which day it's booked for, you can start a keyword search on the appointment message. This is a lot quicker than scrolling through several weeks of crowded diary entries.

DOS services

This is a handy front-end for the normal DOS command line. You start by selecting a volume from a small window on the right-hand side of the screen, and the root directory from this drive is then displayed on the left. A third window at the bottom of the screen shows a series of statistics on the drive, including free space.

You can open up to four volume windows and tab between them to select the active directory. You can mark single files by moving the highlight bar, and groups of files by using wild-cards or the space bar to tag them. The stats window keeps a length tally on the selected files, so you can easily check whether they'll fit on another disk.

Moving or copying files is simply a question of selecting source and destination directories which may be on the same drive, and selecting the files. This is a lot easier than using the command line, and is among the best non-WIMP front-ends I've seen.

DOS services also offers the facility to re-sort the files in any directory by a number of criteria, including size and the order they're stored on the disk. Re-sorting is almost instantaneous, and it's surprising how often you can find a use for the facility, once you know it's there.

The editor

There's something vaguely tautological about reviewing a piece of software by using it. All word processor reviews could be like that, and it would have been possible to write this review on the Homebase editor.

You call the editor from the main Homebase menu, or by typing [Alt][Shift]E, and the screen clears, with only a horizontal file menu across its top. Once you've read-in an existing file or created a new one, the edit window is opened and topped with the filename and a line and column count.

The editor uses WordStar command sequences but only produces straight ASCII text, and misses out on any form of dot command. Against this, a couple of handy extras are date and time strings, which can be deposited in your text at the press of a [Ctrl] key.

The editor is not just used for typing letters and memos, but also pops up within the notebase function for editing 'freeform' records, and within DOS Services to directly edit text files from disk.

You can't justify text under the Homebase editor, and some of the other [Ctrl]Q options are also missing. One of the Homebase options states 'Editor NOT in WordStar compatibility mode', which implies there *is* such a mode. Try as I might, though, I couldn't find one, and no mention is made of it in the manual. Perhaps it's a handle for a future version of Homebase, but as it stands at the moment, functions such as [Ctrl]B, to reformat a paragraph, don't work.

The editor is quite quick, being entirely held in memory, but is only really suitable for memos or short letters, as there's no way of setting margins, or numbering pages, and the only print option is to dump a marked block.

Notebase

The notebase is the core of Homebase. It's a database file which can be created with a pre-set template for each record, or left empty for 'freeform' notes. Notebases can contain all kinds of data. Sample files supplied with Homebase include single record tables of ASCII values and hex/binary/decimal conversion, and templates for a name and address file and a telephone message pad.

A notebase is structured as a set of 'key' fields (of which you may create any

number) and associated 'text' to which can be added notes or details of whatever's described in the keys. The power of the notebase is in the way you can search it. Searches, which are performed via the 'Find' option, may be on keys or the attached text. Key field searches are very fast.

When you select 'Find', an extra window opens for you to enter the search string. The results of the search are held as a subset. You can add other records to this working set from the whole file, or further refine your search using other criteria. Only one subset can be maintained, and is forgotten as soon as you leave the notebase section.

Whole files or working sets can be scrolled through the main notebase window, which can be of any size up to full screen, and normally display only the contents of the key fields. Selecting a single record displays its associated text.

You can adjust the number and size of fields at any stage, even with data in the records, which is rare in a database of any size.

As well as 'freeform' records you can set up a template, which gives a formal display of the information in a record. A template designer is provided as a separate utility, as is a comprehensive report designer and printer. The report printer can be coaxed into printing labels and can merge the contents of a notebase into a text file for mailshots and circulars.

Quick-term

This is a terminal emulator which can be used to send and receive electronic mail, or to link into information services. It includes an auto-dialler, and can be made to operate in the background to cope with any incoming or outgoing calls.

In background mode you are automatically prompted with each incoming call, which then appears in a window on top of whatever application you're running. The text of the call can be fed through this window as it's received, or can be sent straight to a pre-set file for later viewing. The whole system is very smooth in operation, and saves a lot of interruption.

If you prefer to take more of an active part in your comms work, you can use the terminal emulator to work micro-to-micro or link into other information providers. The Homebase auto-dialler is provided with a datafile of its own, and you can flick through all your contacts and call any of them at the press of a button.

The emulator can use the XModem protocol, so is compatible with a lot of comms software, but only straight ASCII, non-protocol files can be sent or received in the background. The terminal itself is completely configurable.

Cut

This Homebase option may be called up from within any of the other options or from an application, and can lift any section of text which can be defined on a single screen. This is done by moving the cursor, pressing [+] and stretching an inverse video window over the required section. The area is saved to memory and may then be deposited at another point in Homebase, or within another application.

You can do some interesting pasting with Homebase. The manual suggests you 'watch the fun' of pasting a column of numbers, cut from a notebase, into the entry window of the calculator (switched to adding mode). Each number is added up and the total may then be cut and pasted elsewhere, perhaps into a text document.

It doesn't always work quite as smoothly as this description suggests, however. If you cut part of a screen which contains graphics characters, they are pasted back as the corresponding alphanumerics. Paste a section of text from the Homebase editor into WordStar, and you may find you only get the first line. Transferring numbers and text from one part of Homebase to another is safest, and is still a versatile feature.

Configuration

For those who like getting their hands dirty, you can install Homebase to meet your own requirements. The Homebase kernel can be configured by changing a number of switches in the config.sys or autoexec files. The options include resetting the 'hot keys' which call Homebase functions from within an application, dealing with an 8MHz system clock, and a number of system defaults.

One of Homebase's useful features, which can be rather unnerving until you know about it, is the 'screensaver'. This simply cuts the screen display after about 15 minutes of inaction. It's meant to preserve the phosphors on your monitor screen, particularly on monochrome tubes.

Compatibility

Homebase seems to be compatible with most common software. There are a couple of problems with WordStar when you're trying to paste text into an existing document, especially if it's double-spaced, but this is more WordStar's problem than Homebase's. It's easy to steer round, anyway, by selecting single-spacing before starting to paste.

The only problem I had with compatibility was with a co-resident onscreen clock utility, but this was only because Homebase was trying to display the same thing, and in the same place on the screen. Switching off either clock cured the problem.

Documentation

Homebase comes with a paperback book, which seems to be a current trend in American software manuals. It runs to 200 pages and covers most aspects of Homebase. There are a couple of places where I found the emphasis misplaced (19 pages on installation against 12 on the editor, for instance), but it's generally well-written, is indexed and includes a quick-reference guide. If Homebase weren't so easy to use, the manual might have been a problem.

Conclusion

Homebase presents itself very well onscreen. The user interface is consistent, using menus at all levels, and enough help is provided to lead you around without being tied to the manual. A couple of options are hidden in rather unexpected places, but nothing that familiarisation doesn't cure.

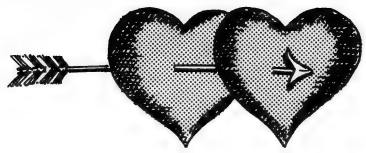
The main sections of Homebase — the notebase, the terminal emulator and DOS services — are useful and well thought out. It's a pity the Homebase disk takes up a drive on a floppy-based PC, as this removes some of the advantages of co-residency, but it's inevitable considering the size of possible notebases and text files.

It's more than useful to be able to cut and paste text, tables and figures from one application to another, and the calculator provides some well-designed extensions to those in other packages. The calendar is flexible enough for all but the busiest person, and the interrupt-driven alarm can prevent a few missed appointments.

The editor is perhaps the weakest link in Homebase. It's not particularly well-documented and lacks a few features, such as a simple printing option, which would integrate it better into the complete product.

Overall, at $89, Homebase represents very good value for money. If you want to run several small databases or have a lot of electronic mail delivered while you work, it may well prove indispensable.

Homebase is available from the Computer Trader. Tel: (03) 417 7044.



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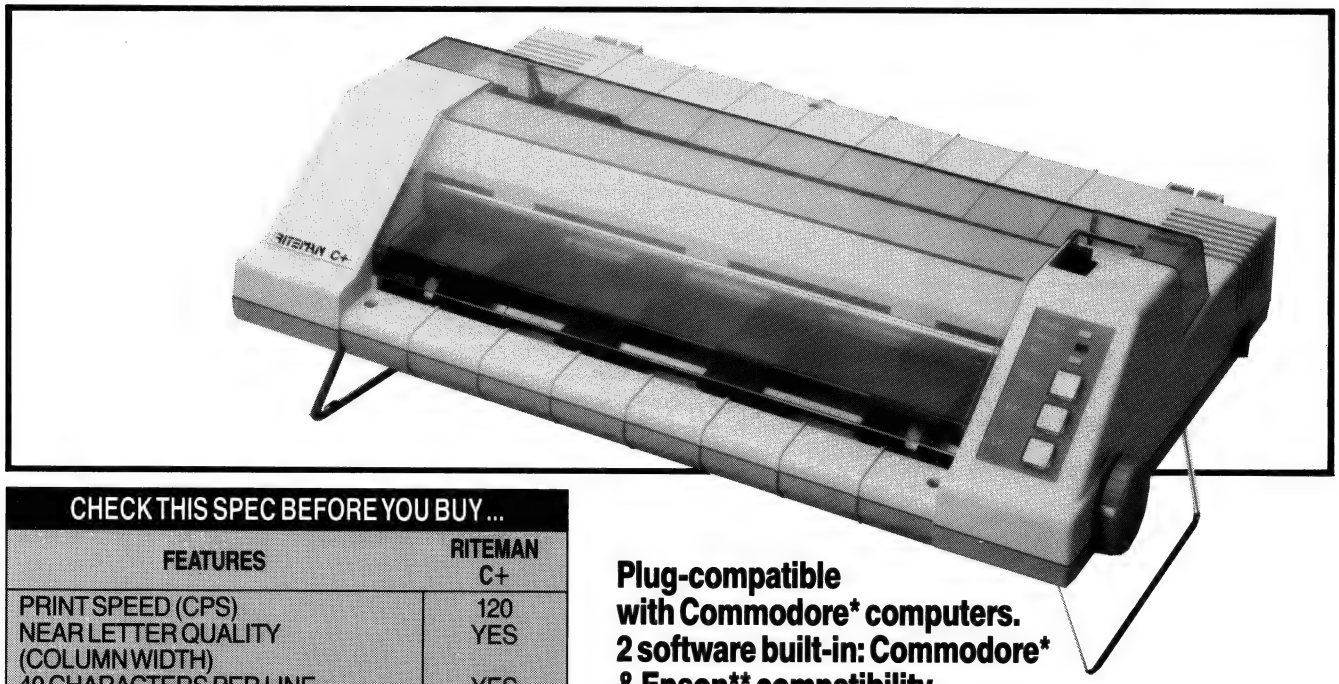

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66 CHARACTERS PER LINE	YES
132 CHARACTERS PER LINE	YES
(PAPER HANDLING)	
FRONT LOADING FOR EASY PAPER SETTINGS	YES
BUILT-IN PRINTER STAND	YES
PRINT ON POST CARDS	YES
(SOFTWARE COMMANDS)	
DOUBLE STRIKE	YES
EXPANDED	YES
EMPHASIZED	YES
COMPRESSED	YES
UNDERLINE	YES
SUPER/SUBSCRIPTS	YES
ITALICS	YES
DOUBLE DENSITY BIT IMAGE	YES
(CHARACTERS)	
9 × 9 FONT	YES
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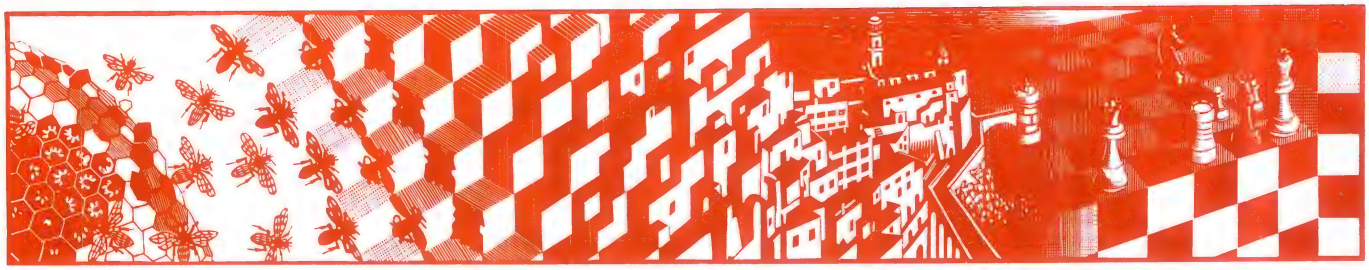
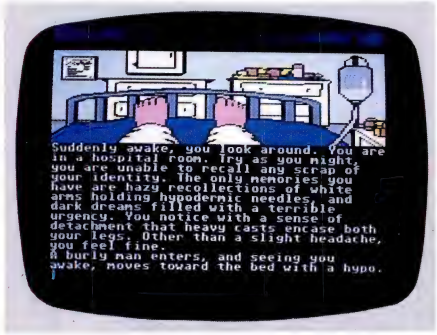


This month Stephen Applebaum delves into the Shadow World, while John Le Fevre takes his Macintosh for a ride with Microsoft's Flight Simulator.



Forever Amber

GAME: Nine Princes in Amber
MACHINE: Atari 520/1040ST
SUPPLIER: Paris Radio Electronics
PRICE: $84.95

Back in the early 1970s, Roger Zelazny wrote a pentalogy of science fiction novels, set in a parallel world called Amber. All five books were successful, by science fiction standards, and have since earned Zelazny cult status among readers of the sci-fi milieu.

Zelazny first introduced his alternate world to the public in *Nine Princes in Amber*, a novel that has recently been turned into a computer adventure by US-based Telarium, a company renowned for bastardising the works of famous, and not-so-famous, authors from various literary fields.

Telarium's version of Nine Princes in Amber follows Zelazny's plot quite closely, but deviates where possible to take advantage of the freedom that a computer offers. Although it isn't necessary to have read the book before playing the game, I'd advise you to do so — the story is quite complex, and it is easy to get lost in the welter of characters which come and go throughout the adventure.

Like Zelazny's original, the game's plot twists and turns with the gut-wrenching ferocity of a switchback ride, where you never quite know which way you're going to turn next.

If you've never played a Telarium adventure, they're generally text-based with a smattering of colourful pictures. Unfortunately, and this is one of the major drawbacks to many American adventures, they tend to access the disk after almost every move. On the plus side, this means that the adventure can be made quite large, the descriptions comprehensive and the pictures numerous. But it also means that they're painfully slow. It's lucky the game is interesting, or you'd find yourself nodding off as the program searches the desk for the next picture or phrase.

Nine Princes in Amber starts with you waking up in a hospital bed, to find your legs in plaster and your memory shot. Drousy and confused, you glimpse an orderly, who is holding a hypodermic needle, standing by your bedside. Without hesitation you grab the needle, then render the man unconscious with a blow to the throat. Hindered by the plaster casts, you tear a metal strut from the bed and break them. To your amazement, your legs are unscathed.

Up until now you had no idea of who you are, why you are in the hospital, or who brought you there. A chart on the wall answers some of these questions. You discover that your name is John Corey and you are 35 years old. You were taken to the hospital by your sister, following a car accident in which you received two broken legs. At the bottom of the chart is your sister's name and address.

You don the orderly's clothes, leave the hospital and catch a taxi to your sister's house. From here on, the plot unravels slowly, revealing your past and present predicament to you piecemeal.

It transpires that your name is actually Corwin, and you are ninth in line to the throne of Amber; and that your car crash was no accident, but a means of getting you out of the way. While you have been unconscious in the Shadow World (Earth), your brothers and sisters have split Amber up into factions, the most powerful of which is led by Eric. Now you must return to Amber and wrest the crown from your squabbling kin.

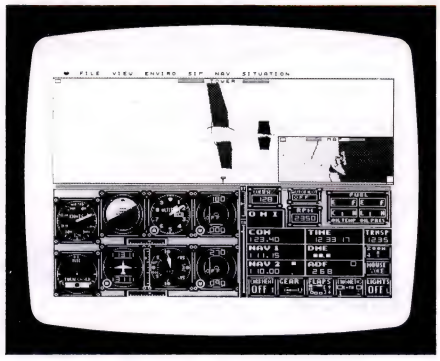
You first reacquaint yourself with your brothers through a pack of Tarot cards, found in your sister's mansion. Upon these cards are printed likenesses of your brothers, clothed in their royal garments; on one card is a portrait of yourself, clothed in black and silver.

Aided by Random, another inhabitant of Amber who has escaped to the Shadow World, you head off on a fantastic journey that takes you from the dirt and grime of New York to the lush landscapes and imminent danger of your world, against which Earth is a mere phantasmagoria by comparison.

Telarium has done a good job of converting Nine Princes in Amber, although as always happens when a book is turned into another medium, much of its original impact has been lost in the conversion. One of the game's major failings is its slow speed, which becomes increasingly more annoying as the game progresses. The pictures used to supplement the text are, on the whole, well-drawn and pleasing to the eye. However, the amount of time that it takes to retrieve each picture breaks up the flow of the game, and makes me feel that it might have been better to forego some of them for the sake of additional text.

If you can spare the time, Nine Princes

in Amber (the game) is well worth a look. It isn't too difficult, so if you're thinking about buying your first adventure but aren't sure where to start, you could do far worse than try this one. Those of you who want to get to know Zelazny's work, however, should buy the book, because Telarium's effort pales next to its pulp counterpart.



High flying

GAME: Flight Simulator
MACHINE: Macintosh
SUPPLIER: Microsoft
PRICE: $115.00

Microsoft has finally answered the calls of Macintosh owners around the world following more than 12 months of speculation and awarded the humble mouse its wings with the release of a Macintosh version of its popular Flight Simulator.

While the fancy colour is missing from the Macintosh version of this almost classical application, the majority of other features have been retained including the choice of either a propeller driven Cessna 182, a Gates Learjet or a WW I fighter ace mode (512k and greater).

However, unlike most other entertainment applications for the Macintosh, Flight Simulator achieves a realism that is absent from most other entertainment applications. While it might at first appear just another simulation package, first appearances can be deceiving, and a full inspection of the various categories under the pull-down menus reveals that Flight Simulator is a full, second generation, real time program considering 39 vital aircraft characteristics necessary in establishing and maintaining flight.

While the application itself is excellent, the same cannot be said about the use of the mouse as a joystick. Keeping the plane pointed in the right direction down the runway is something akin to rolling a semi-trailer tyre in a straight line. Unfortunately the results are that you quite often find yourself running down the unsealed surface beside the taxiway which, in real life, would subject you to questions from aviation authorities about your sobriety and ability to pilot an aircraft.

The selection of onscreen help is simplicity itself and if any of the instruments in the control panel confuse, it is a simple matter of typing "control ?" pointing to the item in question and clicking on it to obtain information as to what the object is and what its function is.

One disappointing aspect of the program is that, while it simulates the noise of each of the aircraft motors very well, it fails to make any use at all of digitised sound to convey to even the Automatic Terminal Information Service which informs pilots of weather and other operating situations at airfields. The lack of this feature is a clear indication that all that Microsoft has done is convert its IBM version of this application over to the Macintosh operating environment, as digitised sound is quite common on Mac software.

Once seated in the cockpit of whichever aircraft you select, you are in the realms of a world which consists of the entire continental United States of America, Canada, Mexico and Caribbean with more than 118 airports available at which to land. The pilot also has the ability to choose dawn or dusk and day or night flying times in any season as well as wind strengths and cloud heights.

The realistic looking control panel of each of the three aircraft available contains the minimum required level of instrumentation to meet the US Federal Aviation Association (FAA) Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) for both day and night flying.

The application is accompanied by a comprehensive 143 page user manual that resembles a pilots handbook more than a software instruction manual, and novice pilots are warned it is wise to spend at least some pre-flight time inspecting its contents, (unless they want to do considerable damage to a very valuable aircraft).

At all times after loading up the application the pilot is placed in the cockpit of an idling Cessna 182 facing west on runway 27 right at Oakland International airport in California. After going through the necessary pre-flight check list and making any alterations to control sensitivity, weather conditions, reliability and the host of other options available, it is time to taxi to the end of the taxiway and onto the runway to take off.

To actually zoom off into the wild blue (in this case white) skies simply double click anywhere on the windshield and the pointer disappears converting the mouse into the control yoke, or joystick, of the aircraft. To call the pointer back on the screen (allowing selection of any of the pull down menu's) requires no more than a further double click.

By depressing the mouse button and pushing the mouse forward the engine increases in speed and begins to move forward. To take off, simply release the button and move the mouse back slightly and this will raise the elevators and the aircraft will roll down the runway increasing speed until it takes off.

A host of in-built keyboard commands are also supported and allow the altering of numerous controls while in flight, as well as changes in the direction from which you view the aircraft (either from inside the cockpit or from the control tower). The zooming feature also allows a closer look at the aircraft from the ground, or at objects in the distance, and is excellent in its ability to detect every slight movement of the aircraft from stable level flight.

Once in the air it's a matter of keeping the plane flying on a straight and level course and gaining altitude without stalling or ending up in a wild spin back to Terra Firma. If your windscreen should crack and the word crash, (or splash if you are flying over water), should appear then unfortunately you have written off a perfectly good aircraft and killed yourself.

While not pleasant, it is a predictable result when completely untrained 'pilots' attempt to take to the air without any knowledge of flying, but a result that is easily rectified by clicking the close box and typing P to start again.

The Jet capability has been included more as an entertainment feature than a true simulation, though it also requires considerable knowledge and skill to keep it level in the air. The graphics of the Mac have been put to excellent use in the many three dimensional views available, though the Learjet option doesn't seem as good on the Mac as it does on conventional PCs.

Likewise the inclusion of the World War I fighter role is basically of an entertainment nature, though once again it also hosts all of the simulations found with either of the other two aircraft.

While Flight Simulator is a very realistic and factual representation of the skills required of pilots it should be stressed that it is in no way a substitute for any pilot training course. The simulation gives a comprehensive feel for flying and will no doubt provide many hours of entertainment despite its small number of drawbacks. END

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Cont from page 176

```
            x1 < x2                                                    */
        if ( x1 > x2 )
            {
            x = x1 ; x1 = x2 ; x2 = x;
            y = y1 ; y1 = y2 ; y2 = y;
            }
            /* set x to initial start point */
            x = x1;

            /* set 32 bit y to initial start point  with
               <15>.<17> significance */
            lo = 0;
            hi = y1 << 1;

            /* caluiate number of points to plot */
            points = x2 - x1 + 1;
            /* We now calculate m as 32 bits in <15>.<17> format.
               m = ( y2-y1 )/( x2-x1 ) */
            m = gradient( x2-x1 , y2-y1 );

            /* We now plot the points by stepping by 1 in x
               This affects y by an offset of the gradient
               which is added to y as each point is plotted.
               The accumulation is such that the hi word of
               y (hi) is 2* the y coordinate so that rounding
               can be applied. This uses more than the required
               accuracy (1/6400) for convienience */
#asm

nextx:      MOV     AX,WORD line_hi_  ; get 2*y
            INC     AX                ; round 2*y
            SAR     AX,1              ; get y
            PUSH    AX                ; pass y
            PUSH    WORD line_x_      ; pass x
            INC     WORD line_x_
            CALL    pset_             ; set point
            ADD     SP,4
            MOV     AX,WORD line_m_   ; Update lo/hi by m
            ADD     WORD line_lo_,AX
            MOV     AX,WORD line_m_[2]
            ADC     WORD line_hi_,AX
            DEC     WORD line_points_ ; Loop for x points
            JNZ     nextx
#endasm
            }
        else
            {
            /* The line has |gradient| > 1 so we use x = my + c
               So that y increments we order the points so that
               y1 < y2                                          */
            if ( y1 > y2 )
                {
                x = x1 ; x1 = x2 ; x2 = x;
                y = y1 ; y1 = y2 ; y2 = y;
                }
            /* set y to initial start point */
            y = y1;

            /* set 32 bit x to initial start point with
               <15>.<17> format */
            lo = 0;
            hi = x1 << 1;
            /* calculate number of points to plot */
            points = y2 - y1 + 1;

            /* We now calculate m as 32 bits in <15>.<17> format.
               m = ( y2-y1 )/( x2-x1 ) */
            m = gradient( y2-y1 , x2-x1 );

            /* We now plot the points by stepping by 1 in y
               This affects x by an offset of the gradient
               which is added to x as each point is plotted.
               The accumulation is such that the hi word of
               x (hi) is 2* the x coordinate so that rounding
               can be applied. This uses more than the required
               accuracy (1/2000) for convienience */
#asm

nexty:      MOV     AX,WORD line_hi_  ; get 2*x
            INC     AX                ; round 2*x
            SAR     AX,1              ; get x
            PUSH    WORD line_y_      ; pass y
            PUSH    AX                ; pass x
            INC     WORD line_y_
```

at the inputs, the calculations required, and the end result; we can then start to design the methodology for the solution. In this case, the inputs are two sets of valid coordinate points on the display. We will use a coordinate system that has a one-to-one map between pixels and display coordinates, so that the x (or horizontal) coordinate will lie between 0 and 639 inclusive, and the y (or vertical) coordinate will lie between 0 and 199 inclusive. We will then be given two sets of valid coordinates (x1,y1) and (x2,y2), and we must produce a line which joins these two points without any 'gaps' in the line (this means that for each x in [x1,x2] we have set a pixel, and for each y in [y1,y2] we have set a pixel). To define the calculations, we note that any such line can be represented by the equation:

$y = m*x + c \ldots (1)$

where m is the 'gradient' and c the 'y-intercept' of the line. The m and c values are defined by the (x1,y1) and (x2,y2) values as follows:

$m = (y2 - y1)/(x2 - x1) \ldots (2)$

$c = y2 - m*x2$ (or $y1 - m*x1$) $\ldots (3)$

We will not, in fact, require the c value, because we note that, given that x1 and y1 are related by the $y = m*x + c$ equation, we have

$y1 = m*x1 + c \ldots (4)$

The next value for y will come from putting $x = x1 + 1$ — that is:

$y = m*(x1 + 1) + c = m*x1 + m + c \ldots (5)$

By comparing (4) and (5), we note that:

$y = y1 + m \ldots (6)$

We soon realise that to go from one y value to the next, we just add the gradient. This suggests the following approach:

1) LET n = number of points between x1 and x2
2) LET x = x1
3) LET y = y1
4) FOR i = 0 to n do
5) set-point (round (x), round (y))
6) LET x = x + 1
7) LET y = y + M
9) NEXT i

There are two points to notice with this method. Firstly, we always increment x, which assumes that x1 <= x2, but this may not be the case so we can adopt one of two approaches:

a) if x2 < x1, then decrement x in statement six; or

b) arrange for x1 < x2 by swapping the coordinates before we start.

We will use option (b) in order that we always increment x in the loop.

The other problem is that we may produce a line with gaps; should m > 1 (that is, gradient > 1), then a step of 1 in

```
                CALL    pset_                   ; set point
                ADD     SP,4
                MOV     AX,WORD line_m_         ; Update lo/hi by m
                ADD     WORD line_lo_,AX
                MOV     AX,WORD line_m_[2]
                ADC     WORD line_hi_,AX
                DEC     WORD line_points_ ; Loop for x points
                JNZ     nexty
#endasm
            }
        }
    }
```

x can produce a step > 1 in y (see statement 7). If we then look at the line from the left (that is, from the y axis) we would see a gap in the line. To solve this, we change our view of the line and consider it to be a function of y so that its equation is given by:

x = (m')*y + c' . . . (7)

The value of m' is given by:

m' = ('x2 − x1)/(y2 − y1) . . . (8)

We can then employ the same procedure as above, but with x and y interchanged (the same conditions for the ordering of the points apply, so we always increment y), and statement seven will read:

7 LET x = x + m' . . . (9)

Fixed-point calculations

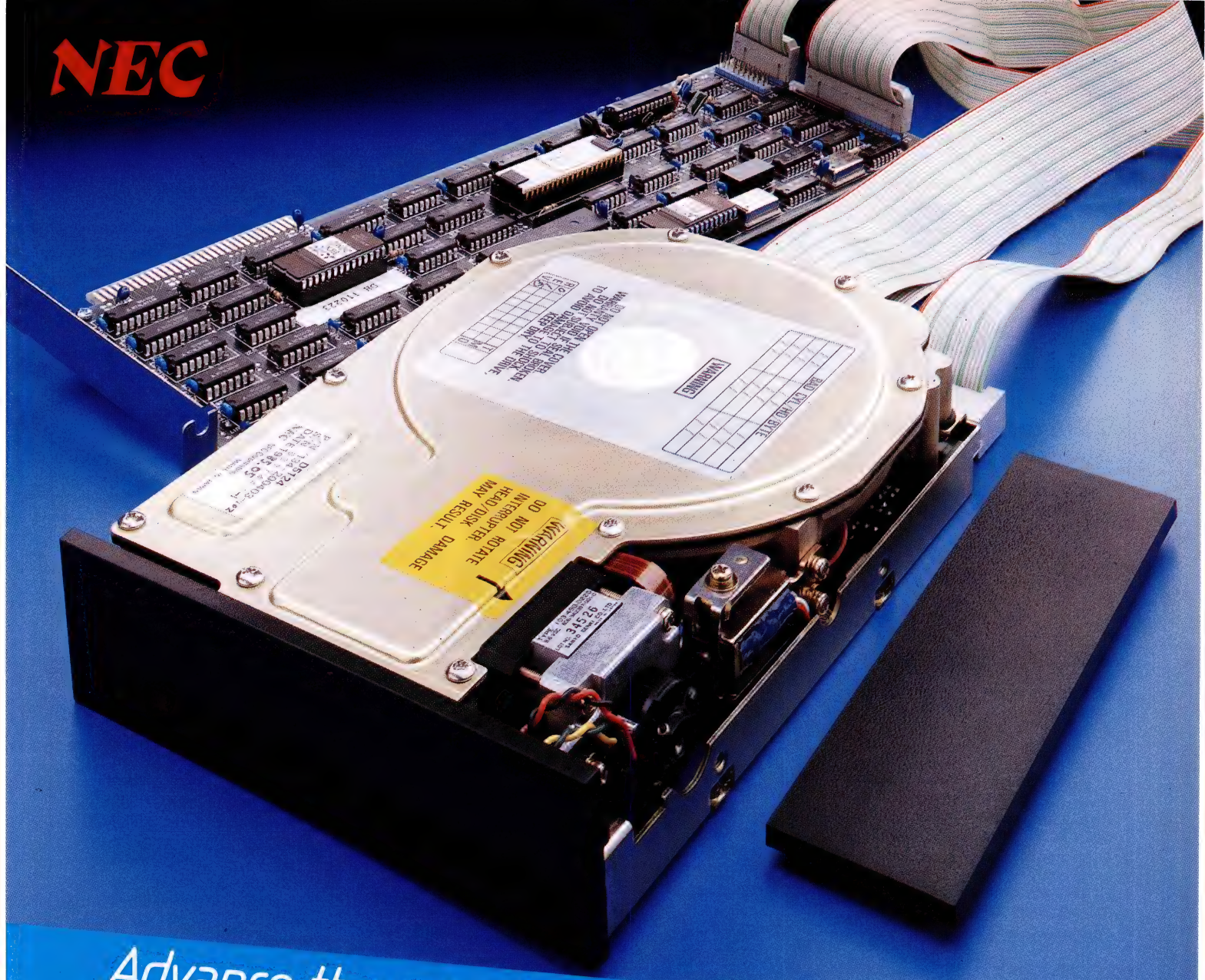
Now that we have decided what calculations we will have to make, we must decide how we will perform the calculations in fixed-point format. The relevant equations are (2), (6), (8) and (9). The equations (2) and (8) are linked in that the calculations are similar, likewise equations (6) and (9). We will concentrate on equations (2) and (6) as the other pair are directly analogous (in fact, they will be calculated in exactly the same way, even though the accuracy constraints are not as great). Starting with equation (6), we know that the range for y is 0 . . 199, so we will require eight bits to store the integer part of y. We are required to round the y value for the set-point routine, so we will require the y value to be accurate to less than 1/10 for all values of y within the loop consisting of statements 4—>8 (if y is 45.41 and is 0.1 inaccurate, then y could be 45.51 and would round to 46 instead of 45). To achieve this for all y values in the loop, we need to know the maximum cycle count of the loop. For the 640×200 display, this is 640. We require an accuracy of greater than 1/(10*640)=1/6400 (suppose that m has an error of 1/6400, say, then after 640 times round the loop, the error has accumulated to 640/6400 = 0.1, which could affect the rounding of the last point on the line). This accuracy requires 13 bits (2^−13 = 1/8192).

We now have the required storage format for y, consisting of eight bits before the binary point and 13 bits after it, which I will denote by <8>.<13> format. We require 21 bits to hold y. This takes us over the 16-bit word of a 16-bit ALU, so we will use a 32-bit integer to store y, which gives us some flexibility as to where we can place the 21 bits within the 32-bit integer (most 16-bit ALUs can handle 32-bit integers, but with less efficiency than 16-bit integers).

Our attention is now drawn to equation (2) which provides the input to equation (6). We already have the required accuracy constraints — determined by y, which is therefore 13 bits after the binary point. The magnitude constraints are that m is in the range [−1, 1], so we require two bits before the binary point (remember we use m or m' to prevent gaps). We now have to devise a method of calculation for m, which is described in terms of the 8068/8 processor on which the procedure will be finally

'The applications of fixed-point arithmetic are wide and varied, from calculating the decimal form of the IBM PC clock value to a high-powered FFT implementation.'

implemented. The 8086/8 processor has provision for dividing a 32-bit integer by a 16-bit integer to produce a 16-bit result with a 16-bit remainder. It is vital that the result lies in 16 bits, otherwise a processor exception interrupt is initiated (65536 div 1 will cause such an exception). We know in advance that −1 <= m <= 1, so we can calcualte 2^14*m and still hold the result in a 16-bit integer. We actually require 2^13*m to be accurate, so calculating 2^14*m gives us slightly more than we require. The way we calculate 2^14*m is to load the 32-bit integer with 2^14*(y2−y1) and divide it by (x2−x1) to leave us with a 16-bit



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integer containing 2^14*m (that is, m is then in <2>.<14> format).

By holding y in 32 bits, we can place the 21-bit representation of y anywhere within the 32 bits we want. In order to simplify rounding later on, we choose to place the bit representing 0.5 in the bit position 16 of the 32-bit integer; we hold y in <15>.<17> format. We must, therefore, coerce m into the same format to enable direct addition of y and m. This consists of shifting m left three bits into a 32-bit integer (after an appropriate sign extension). Note that we could not include this extra scaling of m in its previous calculation, as we were constrained to produce a 16-bit result from the division.

Positive numbers

Before I present the final algorithm, we should investigate how to round a *positive* fixed-point number. To round a positive decimal number, we perform the following operations:
round(x) = int(x+0.5), x>=0
(int (4.49+0.5) = int(4.99) = 4,
(int (4.51+0.5) = int(5.01) = 5

To round a positive fixed-point binary number, we must add in the fixed-point form of 0.5 and extract the integer part. Suppose we have a scaling factor of 2^10: 0.5 is represented by 2^9=512, so we would add 512 and then extract the integer part by dividing by 2^10 (shift right 10 bits). If the fixed-point form is arranged so that bit one represents that 0.5 bit (scaling factor two), then to round, we just increment and shift right once.

The final algorithms are given in Figs 1 and 2, and the procedures (written in DeSmet C) are presented in Fig 3. In order to clarify the DeSmet C procedures, the following points should help:
int: defines a 16-bit signed integer
long: defines a 32-bit signed integer
static: local variable declarations can be accessed from assembler by prefixing the variable name by the procedure name and an '__', and then using the variable name again followed by an '__'; for example: MOV AX,procname__var-name__
long: functions return their result in DX:AX

Out of interest, I Benchmarked my line-drawing implementation against the Bresenham algorithm (as presented on page 435 of *Fundamentals of Interactive Computer Graphics* by JD Foley and A Van Dam). In order to provide a fair comparison, the same routine was used to set a PEL, and both were implemented in DeSmet C. The Benchmark consisted of drawing 1680

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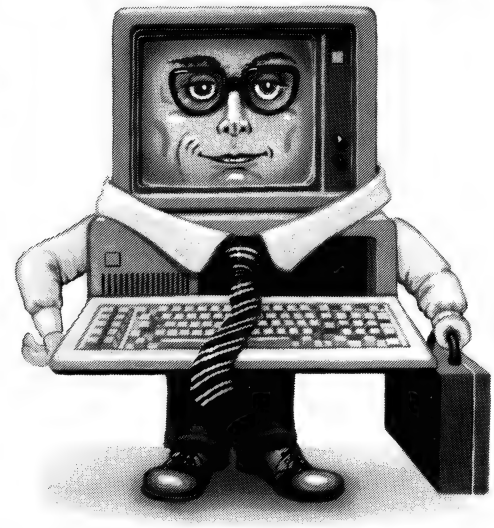

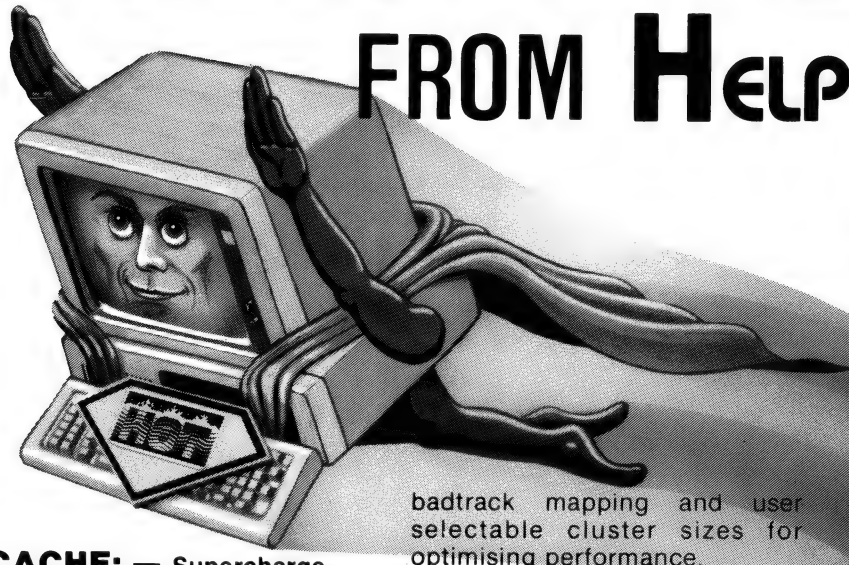

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lines — that is, a line from the centre of the screen to every point on the border of the screen (200+640+200+640 = 1680). The Bresenham algorithm took one minute six seconds while my algorithm took one minute three seconds. The difference is minimal (a five per cent improvement), but there are some points to notice:

1 The fixed point algorithm would improve its performance by using a 32-bit ALU (for example, 68000/32016), whereas the Bresenham algorithm would not (ignoring clock speed, and so on).

2 The fixed-point algorithm uses no jumps (or branches) within the main loop, so a hardware implementation of the algorithm would be possible with a dedicated set of chips performing the calculations. (The chips could be pre-loaded with the x1 or y1 and m values, and upon selection, could calculate the next y or x value within one typical microprocessor instruction period).

3 The fixed-point routine would require alteration in order to move to a higher-resolution display on the x-axis (at the moment, it will cope with anything up to a 1024X1024 pixel display without alteration). The Bresenham algorithm, working with 16-bit signed integers, can go to 16384X16384 without alteration (it can also be written without resorting to an assembler).

Conclusion

The applications of fixed-point arithmetic are wide and varied, from calculating the deicmal form of the IBM PC clock value to a high-powered FFT implementation. I have tried to show how to design and implement a fixed-point algorithm, and hope that all *APC* readers without an 8087 or a VAX will not lose all hope of utilising real-time calculations. The rest is up to you.

END

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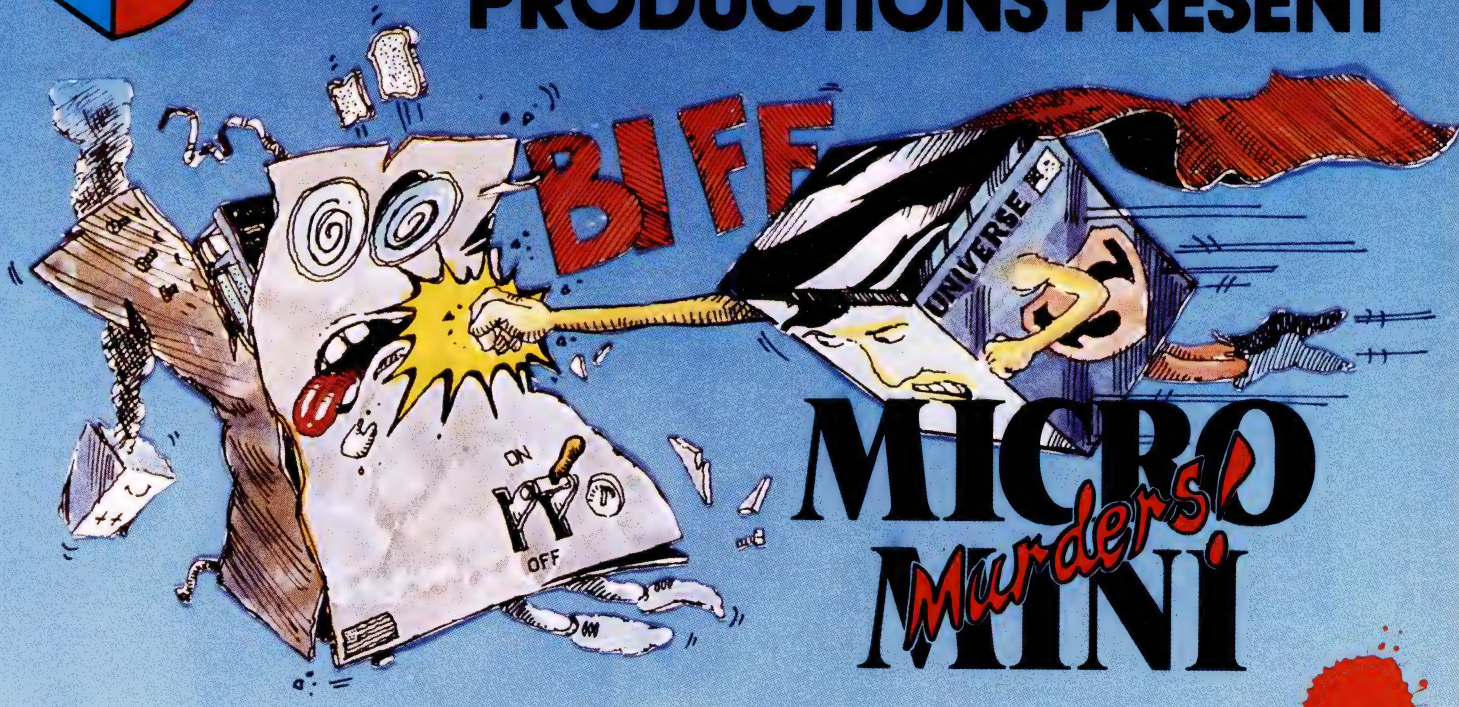

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THE ATLANTIS INTERNATIONAL GREAT GALACTIC CONFLICT

THE AUSTRALIA-WIDE STRATEGY GAME
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WHAT IS THE GREAT GAL

Space. Deep Space. It is the era of inter-stellar travel. And inter-stellar battle.

In our Galaxy — a Galaxy of 25 constellations — all Order has broken down. It is the era of the stellar Warlords — attacking, invading, subduing entire Planetary Systems. The battle for galactic mastery is on.

The Great Galactic Conflict is about to begin . . .

THE GREATEST STRATEGY GAME EVER DEVISED

The *Great Galactic Conflict* is the greatest strategy game ever devised: a large claim, but one this Game will live up to. It is unique.

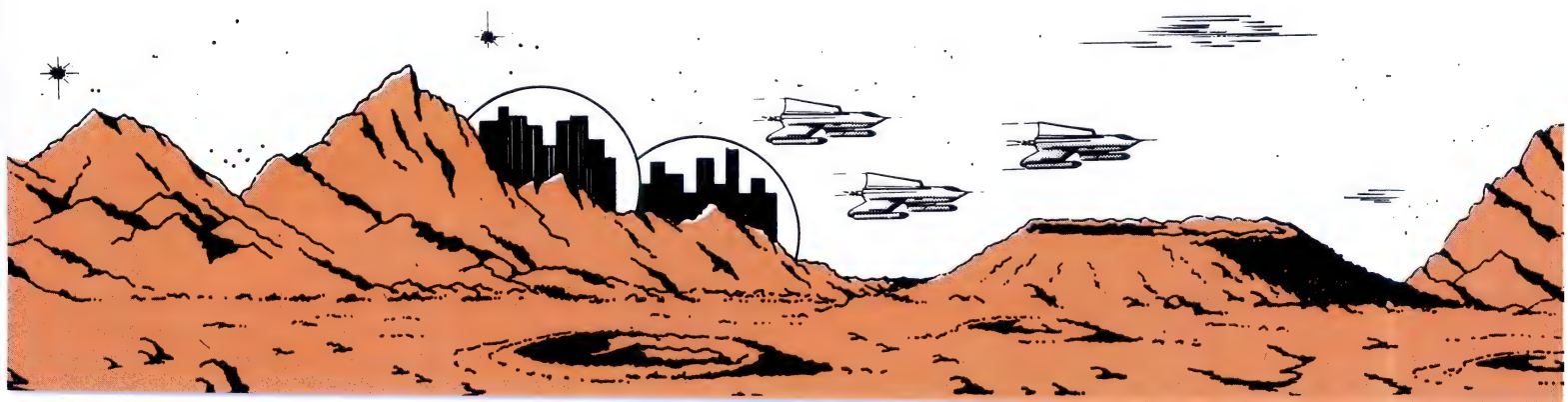
Brought to you by our sponsors *Atlantis International Computers,* in conjunction with *Telecom Viatel* and *Microtex 666,* the *Great Galactic Conflict* features:

* **One thousand players** — playing simultaneously, moving their Battle Fleets across a Galaxy of 25 Constellations consisting of 9,100 locations.

* **$5,000 Prizemoney** — donated by *Atlantis International* — to be shared among 28 skilful winners, the first prize totalling $2,550

* **The Gamemaster** Microtex 666's amazing computer which simultaneously computes the outcome of moves, attacks and conflicts of over 5,500 Battle Fleets, and immediately updates positions, posting results on Great Galactic Conflict's 2,000-plus pages of database on Viatel

* **All Australia** — using Telecom Australia's *Viatel* network the Galactic Warlords participating in the Great Galactic Conflict will be from all across Australia.



ACTIC CONFLICT ABOUT?

The Rules of the Great Galactic Conflict are simple, and everyone will be able to master them.

It is not the playing of the game itself that is complicated — but the winning of it.

Do you possess the strategy, diplomacy and daring to rise above the multitude of minor Warlords and become Master of the Galaxy?

THE STRATEGY . . .

It will take each Warlord just minutes to master the mechanics of moving his or her Battle Fleets about the Galaxy — launching attacks, organising defensive movements, hyper-spacing and so on.

But each Warlord will take hours deliberating just where to attack, which Planetary System to defend, where to hyper-space to, and when. It will be the strategy you employ that will propel you towards your goal — mastery of the Galaxy.

THE DIPLOMACY . . .

But with strategy alone you will not succeed. You will need to converse with other Warlords, forge timely alliances, negotiate treaties and cease-fires, launch joint attacks and plan joint defences.

Through Telecom's *Viatel*, there is plenty of talking as well as attacking to be done.

THE DARING . . .

With strategy and diplomacy you will fare well, but the eventual Master of the Galaxy will have to be daring as well.

Daring enough to risk hyper-space at the height of battle. Daring enough to break treaties, ruthless enough to attack allies, cunning enough to keep every other Warlord guessing as to his true intentions.

ARE YOU READY TO ACCEPT THE ULTIMATE CHALLENGE? IF SO . . . READ ON . . .

A 10 POINT PLAN FOR BECOM

1. GET ONTO VIATEL

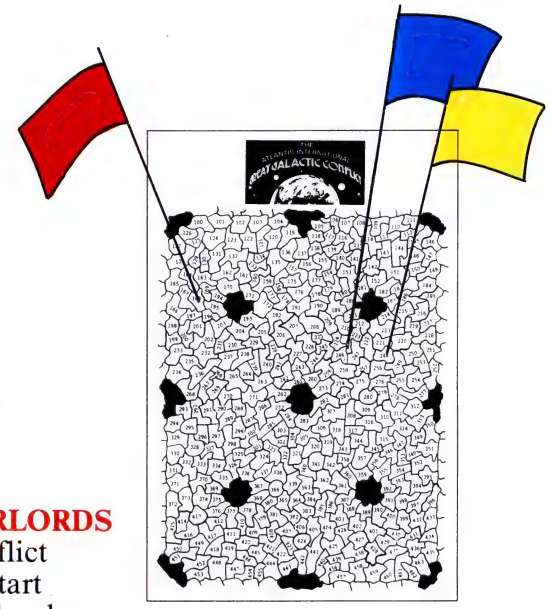
You'll need a PC, and a modem, and a Viatel membership. If you are not already on Viatel then apply now — there is an application form on page 13 of this brochure (call your local Telecom Business Office for more details). Once you are on Viatel access Microtex 666 (Page *66666#) and check out the Great Galactic pages — you don't need to be a member of Microtex 666 to do this.

2. JOIN THE GAME, PICK A NAME

Then apply to join the game. You can do this two ways — on page *6666600# on Viatel (a direct response frame), or fill in the coupon on page 15 of this brochure. But hurry — only the first 1,000 can get into Game I.

3. CHECK OUT YOUR POSITION

Once you've joined the game you'll receive a package from Microtex 666. Rules, Galactic maps, your starting locations (each Warlord starts with four Battle Fleets), and the Itinerary — when the moves will be made. Log on to the Galactic pages on Viatel (all 2,000 of them), and rushing swiftly through the database, check out where in the Galaxy your Battle Fleets are grouped, and whose Battle Fleets are near you. And start scheming.

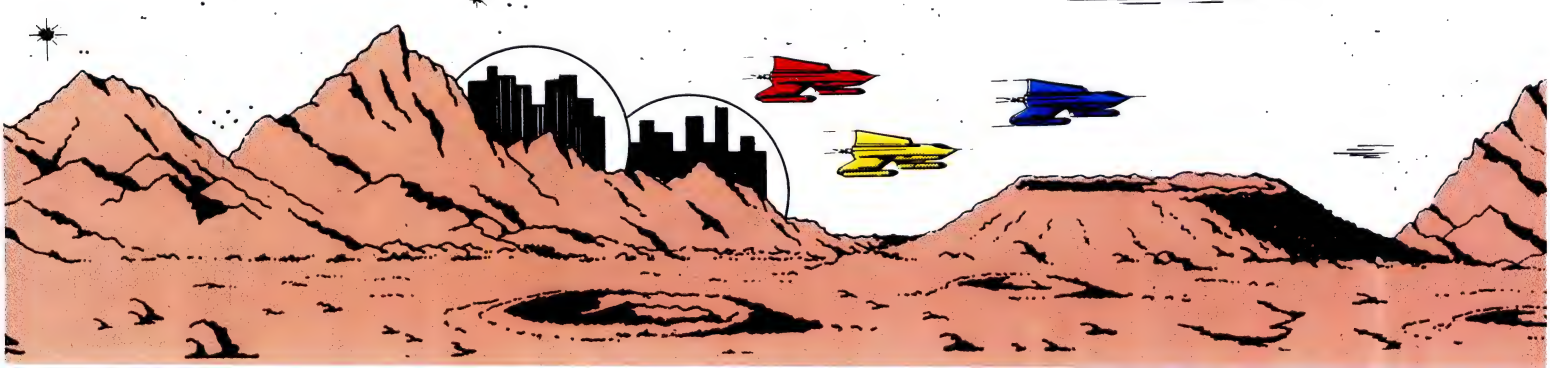


4. MESSAGE THOSE WARLORDS

Using the Galactic Conflict inter-player messaging system, start sending messages to the warlords whose forces are located nearest to you in the galaxy. An alliance perhaps? How do you intend to attack? Can I help? Would you help me? Figure out who you trust, and who you don't.

5. DECIDE ON YOUR ORDERS AND SEND THEM IN

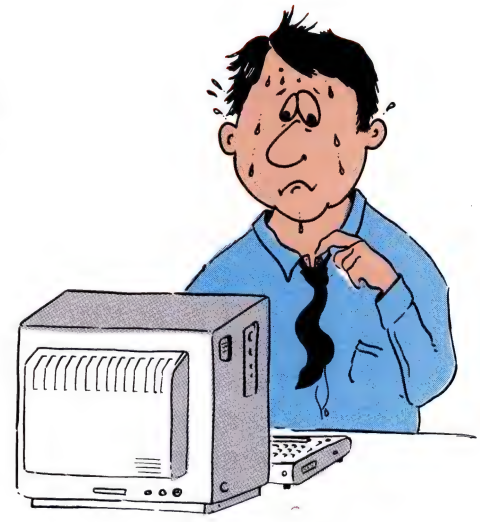
Strategy takes hold. Who is the best to attack now, and why? And how are you going to attack them? Write your orders for your four Fleets, and then log on to the Galactic pages to the Orders frame and post your orders in. Then sit back for a short time, the Microtex 666 Game master computer computes the results of all orders posted.



ING MASTER OF THE GALAXY

6. NERVOUSLY CHECK THE OUTCOME

Check the database! In fact, there are two databases — one which will tell you "current status", where the Battle Fleets are now located after the move, and "Last Moves & Results", which record the order sent to each Battle Fleet on the last move. So you can tell what you have won or lost, and who did what they said they would, and more importantly, who didn't!



7. CHECK THE LEADER BOARDS

Each of the twenty five Constellations (sections of the entire galaxy) has its own score board. See if you have won enough Planetary Systems to get a mention. Then check the BIG ONE — the Game leader board. Are you up in the big prize money, and if not, who is?

8. CHECK THE GAME NEWS

Regular Bulletins about events and changes will be posted throughout the Game, so get into the habit of checking the news pages of the Game. When is the next deadline? When are next orders due? When is the next Com-Link Party?

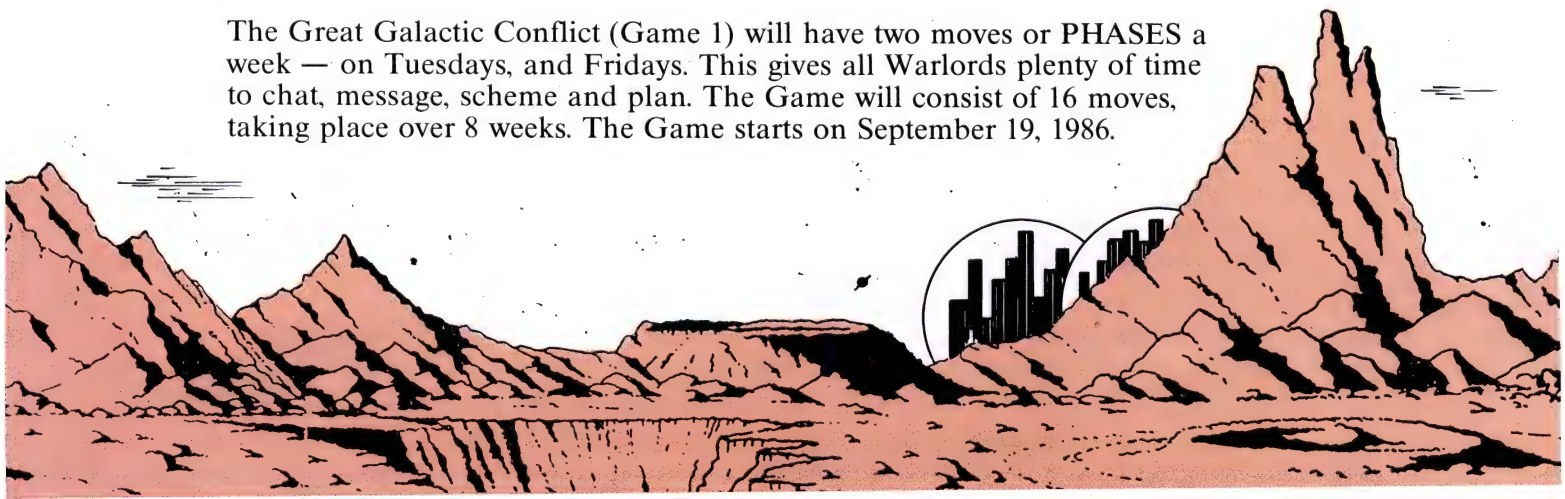
9. GET ON THE INTERSTELLAR COM-LINK & GALACTIC BULLETIN BOARD

The Great Galactic Conflict has its very own Bulletin Board & Interstellar Com-Link — open 24 hours a day and continuously updated to allow groups of players to converse (openly or in code). It also gives you the chance to let everyone else know who double-crossed you!

10. MESSAGE THOSE WARLORDS AND POST YOUR NEXT ORDERS

Get those Battle Fleets ready for action again. New negotiations, new alliances, new orders. The Battle goes. Only 15 more moves before one Warlord is proclaimed the Master of the Galaxy and wins $2,500!

The Great Galactic Conflict (Game 1) will have two moves or PHASES a week — on Tuesdays, and Fridays. This gives all Warlords plenty of time to chat, message, scheme and plan. The Game will consist of 16 moves, taking place over 8 weeks. The Game starts on September 19, 1986.



A GENERAL EXPLANATION OF GREAT GALAC

The Great Galactic Conflict is played on Telecom's Viatel. Each player plays a Warlord, and the aim of each Warlord, not surprisingly, is to gain mastery of the Galaxy.

The Galaxy

The Galaxy is made up of 25 identical *Constellations* — like the Galactic map of one constellation shown on this page. Each of these Constellations are adjoining, creating a "playing area" or Galaxy of 9,100 locations.

Planetary Systems and Star Clusters

As you can see from the map, the galaxy is divided up into locations of two different varieties. The shaded areas are *Planetary Systems*, and each of these, if controlled by a Warlord, supports one Battle Fleet. These are the key locations (or sectors) for each Warlord to win.

The unshaded areas are *Star Clusters*, which have only strategic value in battle (a Warlord may need to occupy a Star Cluster in order to help him/her win, or defend a Planetary System).

The black areas are *Asteroid Belts* and are impassable zones into which Battle Fleets cannot enter.

Starting the Conflict

Each Warlord starts the game by owning four Battle Fleets, all located in Planetary Systems. Occupation of Planetary Systems determines the strength of a Warlord's forces, so the greater the number of planetary systems eventually occupied the larger number of Battle Fleets the Warlord will have in the game. Where a Planetary System is unoccupied, "occupation" is determined by the *last* Warlord who occupied the system.

THE ATLANTIS INTERNATIONAL TIC CONFLICT

Secret names

Each Warlord is known to the other 999 Warlords in the game only by his or her chosen name (for example, Lord Kwon, or Red Invader, etc). The Warlords communicate through the Viatel messaging network. This means that no Warlord knows the *true* identity of other Warlords until the end of the game.

How to win

The winner of the Great Galactic Conflict will be the Warlord who controls or occupies the largest number of Planetary Systems at the end of 16 moves or *phases*.

The mechanics of how to move Battle Fleets across the galaxy, and how Battles are fought between these Battle Fleets can be found on the following pages.

Moves

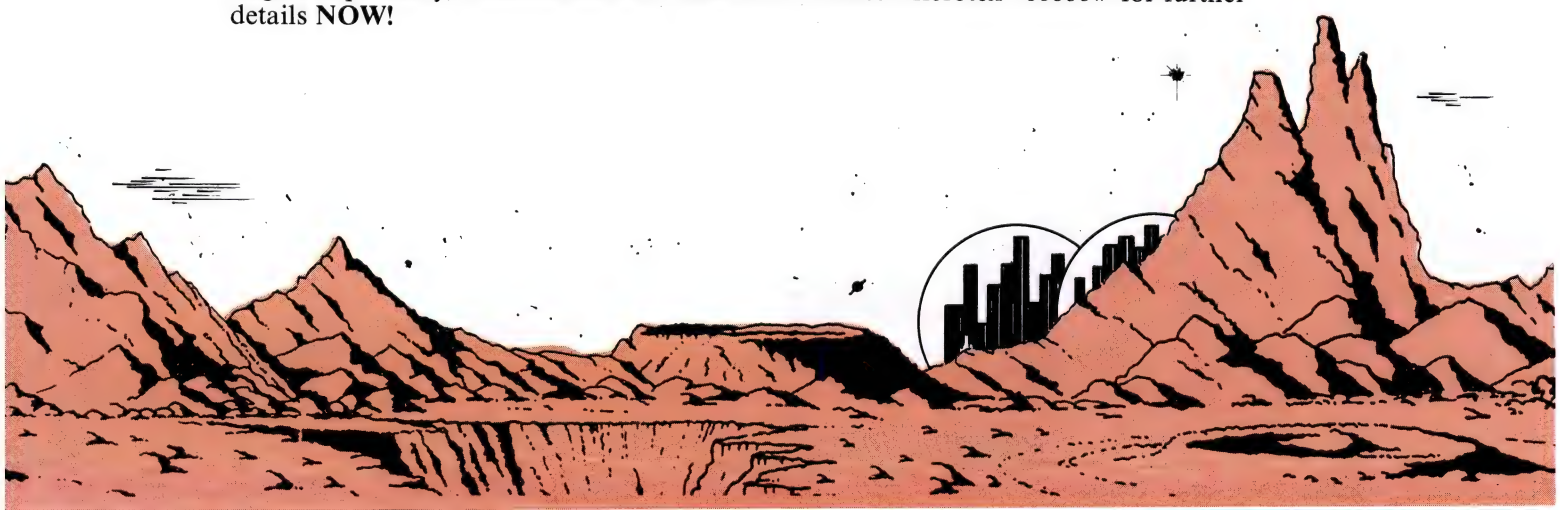
Called *phases* in the Game, two "moves" take place each week. Warlords send instructions to each Battle Fleet commander through a special response frame on Viatel, and these "Orders" are collected in the Microtex 666 computer, the results computed, and the outcomes posted on Microtex 666 — on a 2,000 page Galactic database. Warlords are then ready to prepare their next moves.

This is certain to involve talking, negotiating, and probably arguing with other Warlords on the messaging system! (See our 10 point plan to Master the Universe on the following pages).

What you get when you join up

Microtex 666 will send you the Galactic maps, a set of Rules (fully illustrated), a guide to the Galactic database, and an itinerary explaining when the moves will be made. Plus, of course, the starting positions of your newly acquired battle Fleets.

Several other special features — the *Interstellar Com-Link,* Leader Boards, Galactic News Pages, Diplomacy, Galactic Bulletin Board etc. Access Microtex *66666# for further details **NOW!**



THE GREAT GALACTIC

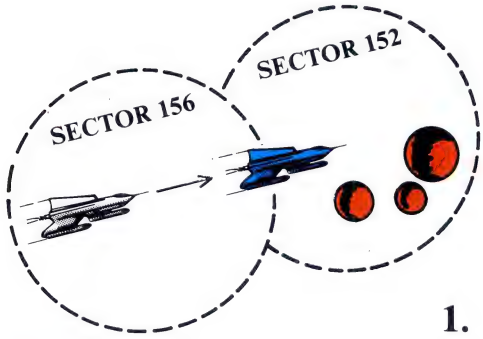
The simple mechanics of battle

How does the Warlord move his Battle Fleets across the galaxy? How are the outcomes of battles decided?

Simple questions, and simple answers.

Just before each phase of the Great Galactic Conflict finishes, each Warlord prepares his or her orders for each of his or her Battle Fleets, and those of his opponents close by in neighbouring sectors.

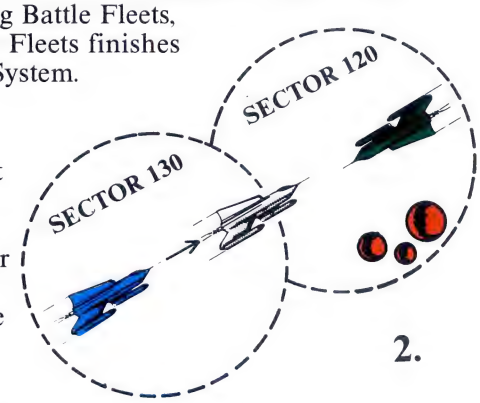
The Warlord has then to decide how he wishes each individual Battle Fleet to act. Let us look at some basic examples:



1.

1. Our Warlord — let us call her Erana — sees that her Battle Fleet in Sector 156 is adjacent to an unoccupied sector — 152. Better still, the unoccupied sector is a Planetary System. Should Erana win control of this sector (by occupation) then she can "build" an additional Battle Fleet, increasing her fire power.

Erana thus Orders the Battle Fleet in sector 156 to *attack* (ie move into) sector 152. Since there are no opposing Battle Fleets, the attack is successful, and the Battle Fleets finishes the *phase* control of a new Planetary System.



2.

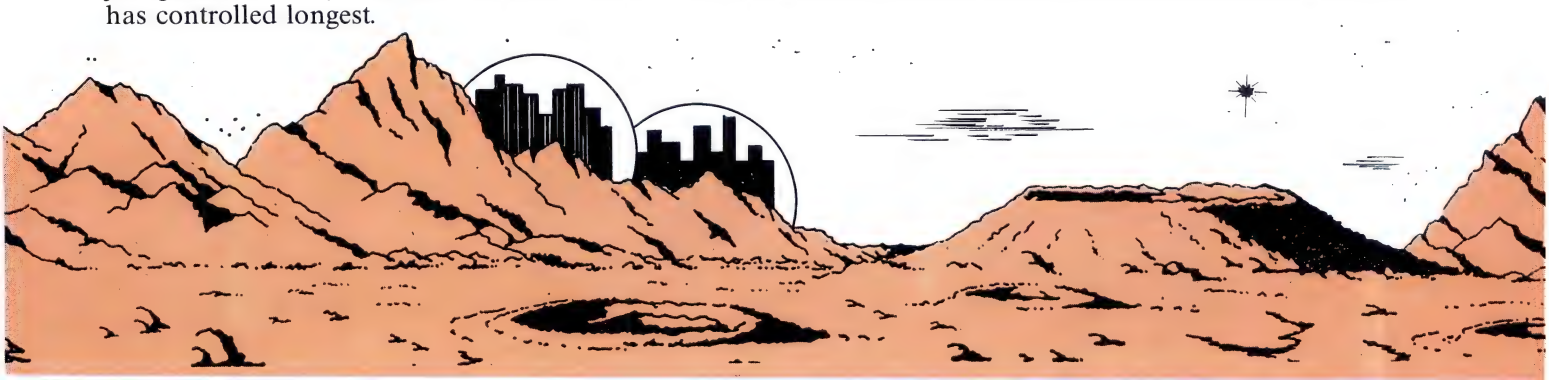
2. Erana also notices that her Battle Fleet in sector 130 (blue) is adjacent to a further planetary system — in sector 120. Sector 120 is, however, presently occupied by a Battle Fleet controlled by the Warlord Vegan (green). Nevertheless, she decided to order her battle Fleet in sector 130 to *attack* sector 120. This attack is unsuccessful, because since Vegan ordered his Battle Fleet to remain where it was the two Fleets were evenly matched — one against one — so the result was a stalemate, neither Battle Fleet moving.

3. A few *phases* later . . . we discover Erana has called up reinforcements. She has now moved a second battle Fleet into position adjacent to sector 120 (which is still occupied by a Battle Fleet belonging to Warlord Vegan). Erana launches her offensive — she orders the Battle Fleet in 130 to *attack* sector 120 as before. And this time she orders her Battle Fleet in sector 131 to *reinforce* the *attack* of her battle Fleet in sector 130.

Again, Vegan orders his Battle Fleet to remain where it is, but this time the odds are different. Erana attacks with the force of *two* Battle Fleets, while Vegan defends with the force of just *one* Battle Fleet. The Eranians are therefore successful.

So what is the outcome of this battle for sector 120?

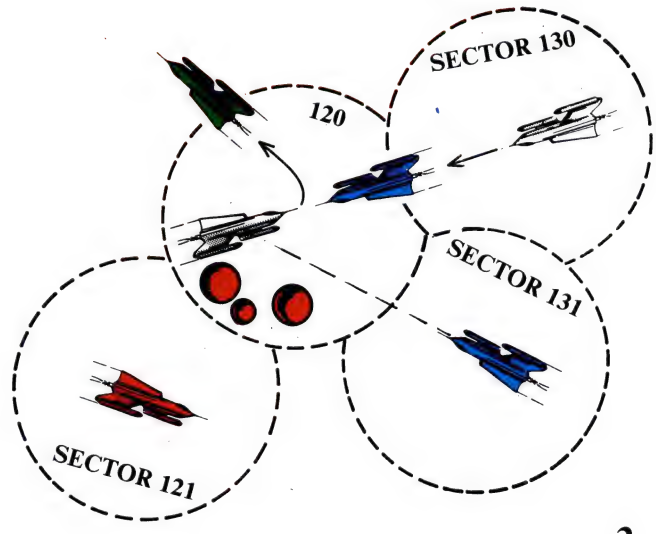
Firstly, Erana's battle Fleet occupies sector 120 (only one Battle Fleet may occupy each sector). Since she has just gained mastery over another Planetary System, a new Battle Fleet is added to her forces in the sector she has controlled longest.



CONFLICT EXPLAINED.

Secondly, Vegan's Battle Fleet has had to retreat out of sector 120 to an unoccupied adjacent sector. The Battle Fleet is not destroyed, but since Vegan has lost control of one Planetary System, one of his Battle Fleets will be destroyed — the latest addition to his forces (which may or may not be the Battle Fleet ousted from sector 120). Could Vegan have avoided defeat? Yes, of course. He could have asked a neighbouring Warlord, Casius (pink) to order his Battle Fleet in sector 121 to *uphold* (or defensively support) the Vegan Battle Fleet in sector 120. This would have meant the Battle Fleet in sector 120 had the defensive force of *two* Battle Fleets, matching the attacking force of the Eranian Battle fleet in sector 130 which also had the force of *two.* The result would have been a further stalemate. This example shows the importance of *alliances.*

As you can see the rules are simple. But in a large crowded Galaxy, with one thousand warlords, situations get very complicated very quickly. Look at our next example!



3.

4. DIPLOMACY IS THE KEY

In the example, the Planetary System controlled by Vegan (sector 160) is very much under threat. Pretend for a moment you are playing Erana. What would you do? You could attack sector 160 with a force of 2 Battle Fleets, but Orlando may well do the same, also with a force of 2. The attacks would cancel each other out, and the Vegan battle fleet would survive.

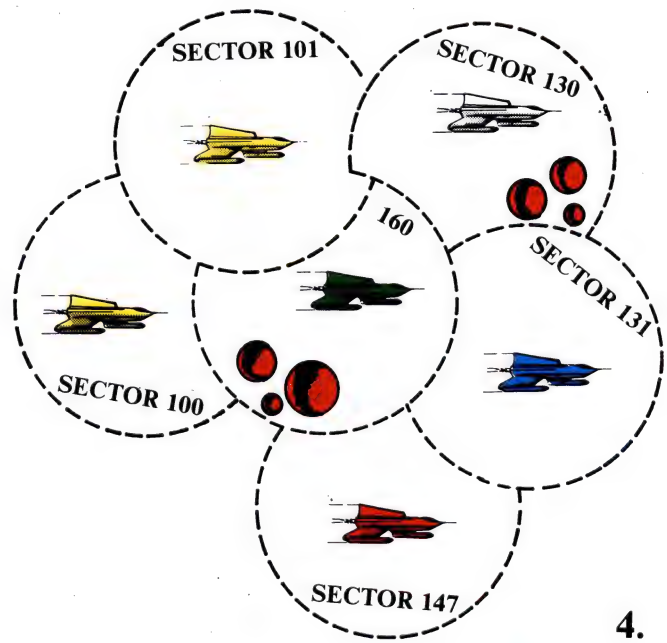
You might try and negotiate an alliance with Casius, asking him to *reinforce* your attack, giving your attack the power of 3 against Orlando's 2, and thus ensuring victory.

Orlando, on the other hand, may suspect that you are in league with Casius, and rather than *attack* Vegan knowing that with Casius's support you would win the planetary system, Orlando may decide to *uphold* Vegan's Battle Fleet in sector 160 because he would rather Vegan occupied the planetary system than you.

Meantime, Vegan may well be asking Casius for support as well, knowing that if Casius supported his threatened Battle Fleet, it would survive. He would probably promise to aid Casius in some attack later in the game.

Of course, Vegan may be in league with Orlando, and together they may be planning a surprise attack on your planetary system in sector 130 . . .

Persuasion, bargaining, alliances, double-crossing, long term tactics, short term tactics — this, more than anything is the challenge, the excitement and the fun of the greatest computer game you'll ever play.



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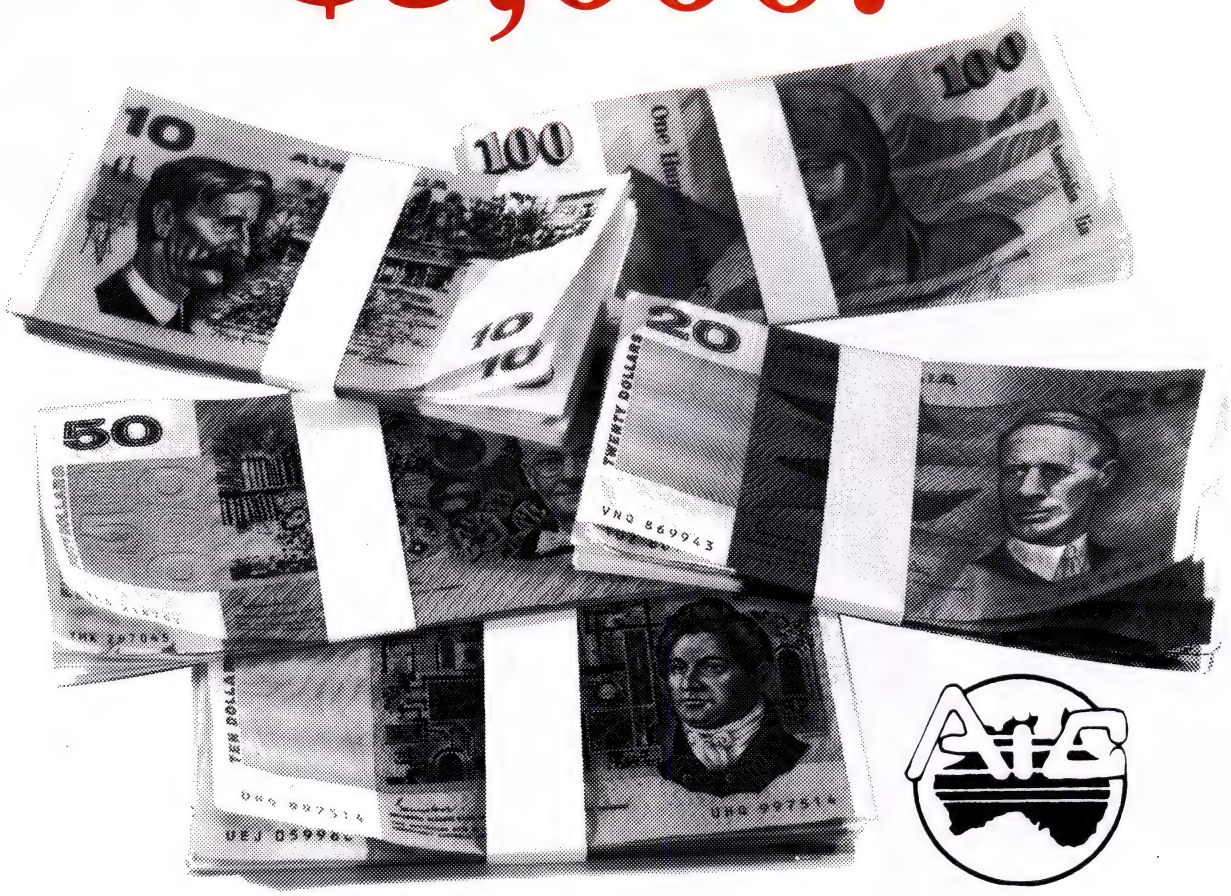

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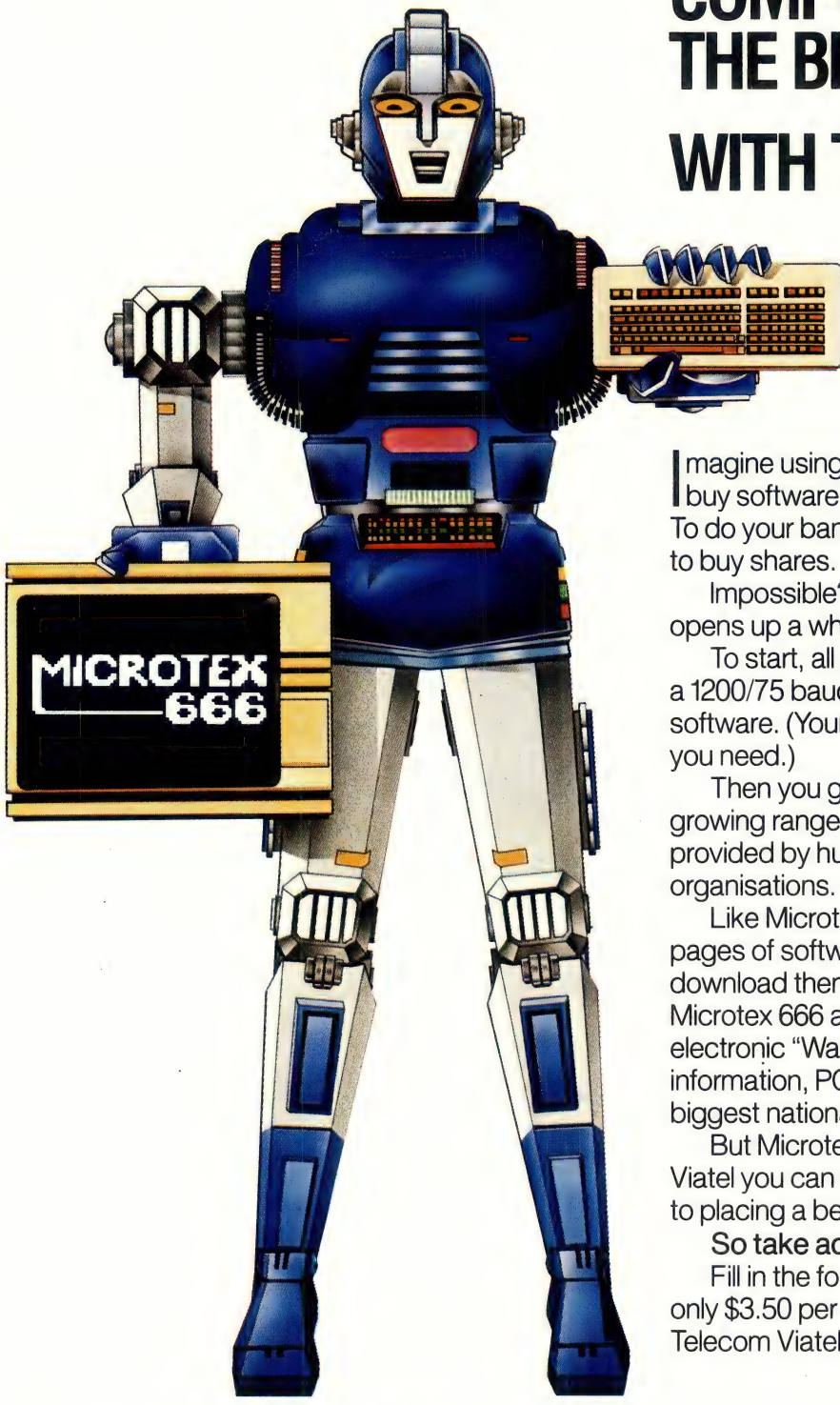

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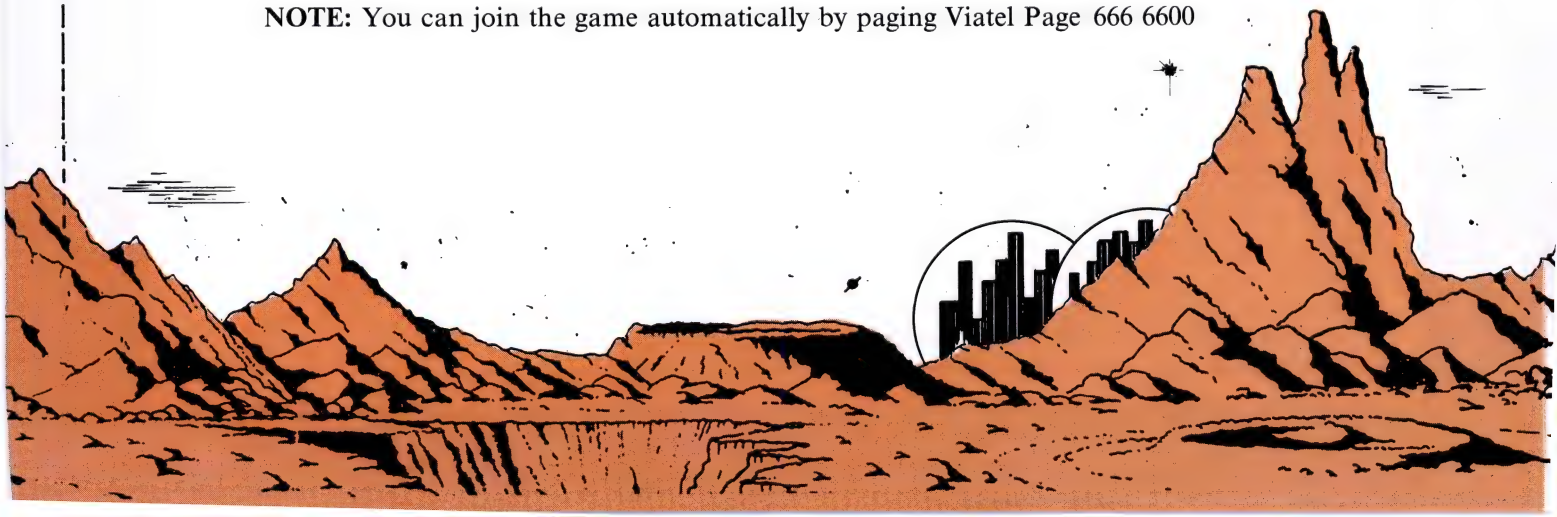

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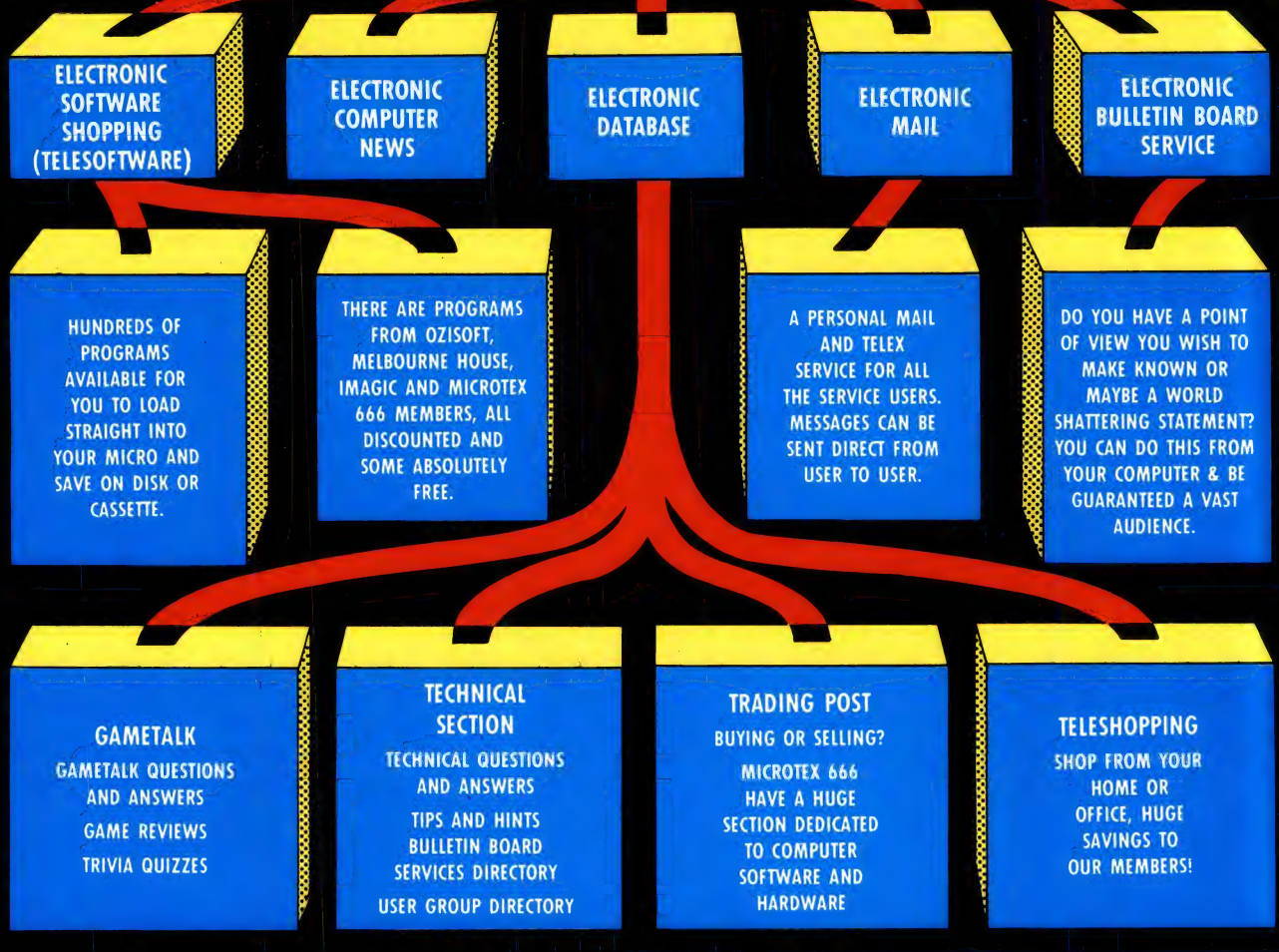

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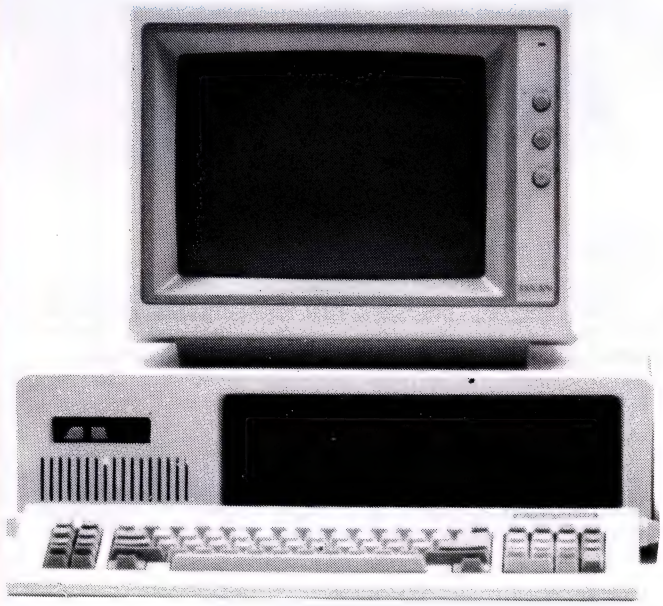

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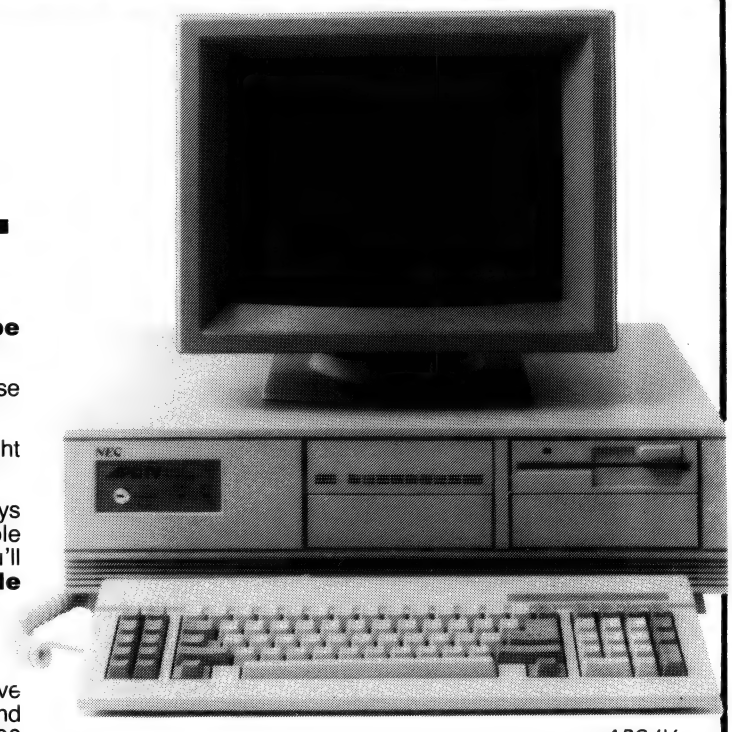

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COMMUNICATIONS

Steve Withers reveals a new user group in this month's round-up of what's new in the world of PC communications.

The Victorian Online Users' Group has existed for two years, but it seems it has been hiding its light under a bushel. The first we knew of the group was when a member gave us some information about a (then) forthcoming meeting in Melbourne. Although you probably hadn't read the *last* issue of *APC* by the day of the meeting, we thought we would mention it as an indication of the group's interests. Under the title "Computer Crime: Can you hack it?", the meeting took the form of a panel discussion. The often-quoted Kevin Fitzgerald took part, along with people from Telecom and Australian Information Retrieval Services.

Judging by the questionnaire for prospective members, the group caters for users of on-line services, from specialised databases to bulletin boards. One activity under consideration is the provision of training sessions for specific services at minimal cost. Given the customarily high charges for commercial training, that could be sufficient reason for joining. You can contact the group c/- PO Box 284, Heidelberg 3084. The subscription is a very reasonable $10/ year for individuals, or $25 for organisations.

We would be happy to mention similar groups in other states if their members would provide details.

PC CD

Last month we mentioned a UK system that is planning to incorporate a CD-ROM to provide convenient storage of a large quantity of public domain software. If that sparked your imagination, you will be pleased to hear that a similar disk is now being sold by PC-SIG, a US IBM PC users' group. This CD-ROM holds the equivalent of 490 floppies and sells for $US195. The group also offers a CD-ROM player (Hitachi) with the necessary driver software, interface, and cables for $US995. Before ordering the player, we suggest you contact Hitachi in Australia to check local prices and availability. PC-SIG's address is 1030D East Duane Avenue, Sunnyvale, CA 94086, USA.

Modems

Just after the last column went to press, we heard about a Taiwanese made 1200 baud full-duplex modem that was selling in Melbourne for approximately $450. As we haven't had the opportunity to try the device, we won't mention any names, but the news came from a very satisfied user. Allowing for inflation, that must be roughly equivalent to the price we were paying for 300 baud modems when bulletin boards first took off in Australia. It seems that some BBS operators have been waiting for 1200 baud modems to fall to a price that 'Joe Blow' can afford before upgrading their systems to support 1200 — we believe that price has probably been reached.

Midas directory

Modem Technology (the data communications company) has launched a quarterly publication called *Data Communique*. It is primarily a Minerva directory, but (unlike the phone book) allows you to find the name that goes with the user ID, as well as letting you look up a subscriber's ID when you know the name. Additional information includes a list of BBSs. If this sounds useful, a one-year subscription is available from Mr Chris Murray, Modem Technology Pty Ltd, PO Box 662, Castle Hill, NSW 2154 (or Minerva ID MTP001).

Corrections and updates

Our thanks this month go to Mark James.

NSW

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We would be grateful if anyone could confirm whether the following Sydney boards are still operating: Andromeda, CCUA, Galaxy, Keeboard, Renegade, Scorpio, Skull, Sorcerer Users Group, and Sydney Public Access.

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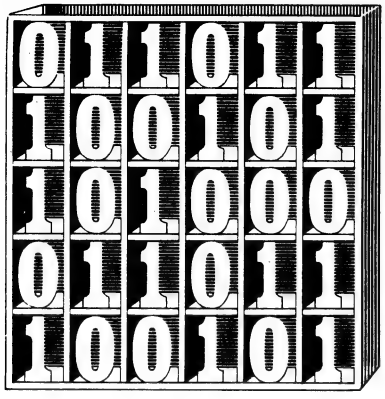

David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to Subset, APC, 2nd Floor, 215 Clarence Street, Sydney 2000.

Z80 32-BIT ARITHMETIC

The first six datasheets this month, from T Sullivan, form the basis of an excellent but unusual 32-bit integer arithmetic suite. The seventh datasheet, POWX, calculates positive integer powers. While not matching the speed and efficiency of the 68000's single instructions, the suite demonstrates that higher-precision arithmetic on the Z80 can be reasonably short and fast when all options are carefully thought out.

The suite's internal operations act on arguments contained in registers. This is much faster than operations on values held in memory. However, as far as the calling program is concerned, each argument or variable resides in four bytes of memory and is addressed by one of the register pairs: HL, BC or DE.

The storage order in memory reverses that normally found in Z80 code, and has the high-order bytes first in low memory. This method is unusual, but does have much to recommend it. I can think of two major advantages: numbers are easier to read in a dump; and the variable's sign bit resides at the addressed byte, enabling quick sign reference. Although Z80 purists might object, the only disadvantages are quite niggling: the four bytes have to be picked up individually rather than by two 16-bit loads, which cause reverse ordering in the registers; and any initial values have to be assembled by four DEFBs rather than by two DEFWs.

More unusually, the values are not stored or acted upon as two's complement numbers, but are kept in memory as sign bit and 31-bit magnitude (absolute value). All routines in the suite extract the sign bits from the arguments and work separately on the positive values and signs.

Simple addition and subtraction is slowed considerably by using the signed magnitude format, but there are obvious benefits for multiplication, division and exponentiation, which operate on absolute values. Sign bit extraction and manipulation is far quicker than testing input arguments and output results for possible 4-byte negation.

The most unusual aspect is the use throughout the suite of the Z80's alternate register set — AF, BC, DE and HL. Without this extra register bank the Z80 has only A, F and five 16-bit registers, and this number is not sufficient for most 32-bit arithmetic operations. With the extra set, a Z80 programmer has eight 16-bit registers, two 8-bit accumulators and two sets of flags at his or her disposal, though not all are available simultaneously.

Use of the alternate registers is frowned upon in SubSet, since some operating systems reserve their use for fast interrupts. It takes eight program bytes, eight stack bytes and 84 clock cycles (time states) to PUSH and POP AF, BC, DE and HL, but switching between register sets can save and restore the interrupted state in only four program bytes, zero stack bytes and 16 clock cycles. The suite has a non-interruptable classification, since its routines rely on the alternate registers and could find their data suddenly and inexplicably corrupted by a previously transparent interrupt. Nevertheless, it should present no problems in situations where interrupts can be guaranteed not to corrupt any registers.

Structure: The suite has eight main entry points — ADDX, SUBX, CMPX, MULX, DIVX, MODX, SQX and POWX, acting on signed variables, and 14 internal subroutines dealing with I/O and magnitude operations. Most of the main routines are reduced to a short sequence of subroutine calls by the highly-structured approach. However, I think the structure is *too* rigid, giving rise to some time-consuming anomalies. For example, SQX requests XENTRY to read and process a variable addressed by BC when only that addressed by DE is required, and the signed comparison, CMPX, might be achieved more efficiently by using the accumulator A to compare bytes still resident in memory.

XENTRY does five separate jobs. At the cost of a few extra bytes, a set of six routines to: (1) save registers; (2 to 5) load a variable to any of BCBC, DEDE, HLHL or IXIY while extracting the sign bit to Carry Flag; and (6) shift Carry into A, storing the parity of 7-bit A in bit 7, A, would have greater flexibility, and so be far more useful to any additions to the suite.

DATASHEET 1

```
;
;> XENTRY - Entry routine for 32-bit signed arithmetic routines.
;> XEXIT  - Exit routine for 32-bit signed arithmetic routines.
;> RESTOR - Register restore routine.
;
;JOB         To provide entry and exit facilities for 32-bit
;           arithmetic suite; saving registers and loading
;           arguments; storing result and restoring registers.
;           XENTRY is CALLED by arithmetic routines.
;           XEXIT & RESTOR are JUMPED TO by arithmetic routines.
;ACTION      See individual routine comments.
;
;CPU         Z80
;HARDWARE    Variables in RAM.
;SOFTWARE    CLRH, NEGH.
;
;INPUT       XENTRY:  DE & BC address the two arguments.
;                     HL addresses the result variable.
;            XEXIT:   Cy=0: HLHL' contains valid result.
;                          Bit 7,A contains result sign.
;                     Cy=1: No valid result.
;OUTPUT      XENTRY:  All registers & flags stacked.
;                     Result address on top of stack.
;                     DEDE' = magnitude of input (DE...DE+3)
;                     BCBC' = magnitude of input (BC...BC+3)
;                     HLHL' = 0
;                     Bit 7,A = sign DEDE' XOR sign BCBC'
;                     Bit 6,A = sign DEDE'
;                     Bit 5,A = sign BCBC'
;                     Bits 4-0,A = 0.       Cy = 0
;                     IX & IY changed.
```

```
;            XEXIT:    Cy=1: Jump to RESTOR.
;                      Cy=0: Sign + magnitude of result
;                            stored to address from stack top.
;                            Z = result zero status.
;                            Fallthrough to RESTOR.
;            RESTOR:   All registers and alternate F restored.
;                      Normal F preserves output from routines.
;ERRORS      None.
;REG USE     F BC DE HL (suite use of all registers).
;STACK USE   XENTRY: 24 (leaves 22 bytes on stack at return).
;            XEXIT: 2 (then RESTOR).
;            RESTOR: -22.
;RAM USE     None.
;LENGTH      XENTRY: 71.  XEXIT: 28.  RESTOR: 19.
;CYCLES      Not given.
;-------------------------------------------------------------
;CLASS 2      *discreet       -interruptable      *promable
;*-**-*       *reentrant      -relocatable        *robust
;=============================================================

;
XENTRY EX   (SP),IY    ;Save IY getting return address.  FD E5
       PUSH IX         ;Save IX.                         DD E5

       PUSH HL         ;Save normal regs, HL, DE & BC,   E5
       PUSH DE         ;as addresses of variables,       D5
       PUSH BC         ;(HL) = (DE) op'n (BC).           C5
       PUSH AF         ;Save normal accumulator & flags. F5
       EXX             ;Access alternate registers.      D9
       PUSH HL         ;Save alternate regs,             E5
       PUSH DE         ;HL', DE' & BC'.                  D5
       PUSH BC         ;                                 C5
       EXX             ;Access normal regs.              D9
       EX   AF,AF'     ;Access alternate acc. & flags.   08
       PUSH AF         ;Save AF'.                        F5
       EX   AF,AF'     ;Access normal AF.                08
       PUSH HL         ;Save result address to t-o-s.    E5
       PUSH IY         ;Push return address for return.  FD E5
;
;...get two arguments (DE) & (BC) to regs & clear HLHL'.
;
       CALL CLRH       ;Clear 32-bit accumulator HLHL'.  CD lo hi
       PUSH DE         ;Move arg1 address from DE        D5
       POP  IX         ;to IX.                           DD E1
       PUSH BC         ;Move arg2 address from BC        C5
       POP  IY         ;to IY.                           FD E1
       LD   D,(IX+0)   ;Load arg1 hi-word to DE.         DD 56 00
       LD   E,(IX+1)   ;                                 DD 5E 01
       LD   B,(IY+0)   ;Load arg2 hi-word to BC.         FD 46 00
       LD   C,(IY+1)   ;                                 FD 4E 01
       EXX             ;Access alternate regs.           D9
       LD   D,(IX+2)   ;Load arg1 lo-word to DE'.        DD 56 02
       LD   E,(IX+3)   ;                                 DD 5E 03
       LD   B,(IY+2)   ;Load arg2 lo-word to BC'.        FD 46 02
       LD   C,(IY+3)   ;                                 FD 4E 03
       EXX             ;Access normal regs.              D9
;
;...get signs: arg1 XOR arg2, arg1, arg2. Clear arg sign bits.
;
       RLC  B          ;prepare for clearing signs       CB 00
       RLC  D          ;while copying to A.              CB 02
       LD   A,D        ;Get sign DE XOR sign BC          7A
       XOR  B          ;in 0,A. Shift it to 1,A and      A8
       RLA             ;eventually into 7,A.             17
       SRL  B          ;Clear sign BC while copying      CB 38
       RRA             ;it eventually to bit 5,A.        1F
       SRL  D          ;Clear sign DE while copying      CB 3A
       RRA             ;it eventually to bit 6,A.        1F
         RRA             ;Get XOR sign to bit 7,A.         1F
         AND  0E0H       ;Mask out non-sign bits and       E6 E0
         RET             ;exit to arithmetic routine.      C9
; :
;-------------------------------------------------------------
;
XEXIT  JR   C,RESTOR   ;Invalid result if Cy set.        38 1A
;
       EX   (SP),IX    ;Get result addr. (BP unchanged). DD E3
       CALL NEGH       ;Test if zero, result in DE,      CD lo hi
       AND  H          ;Clear sign if HLHL' was 0.       A4
       AND  80H        ;Isolate sign and merge result    E6 80
       OR   D          ;hi-byte with sign.               B2
       LD   (IX+0),A   ;Store result hi-byte + sign      DD 77 00
       LD   (IX+1),E   ;and 2nd byte.                    DD 73 01
       EXX             ;Access alternate regs.           D9
       LD   (IX+2),D   ;Store result lo-word.            DD 72 02
       LD   (IX+3),E   ;                                 DD 73 03
       EXX             ;Access normal regs.              D9
       SRL  H          ;Bit 7,H set if result NOT zero,  CB 3C
       OR   H          ;so clear Cy & set S & Z status.  B4

;
;-------------------------------------------------------------
;
RESTOR POP  BC         ;Tidy result address from stack.  C1
       EX   AF,AF'     ;Access alternate accumulator     08
       POP  AF         ;and flags, and restore AF'.      F1
       EX   AF,AF'     ;Access normal AF.                08
       EXX             ;Access alternate regs.           D9
       POP  BC         ;Restore alternate registers,     C1
       POP  DE         ;BC', DE & HL'.                   D1
       POP  HL         ;                                 E1
       EXX             ;Access normal regs.              D9
       POP  BC         ;Pop stacked input AF and         C1
       LD   A,B        ;restore A without changing F.    78
       POP  BC         ;Restore normal registers,        C1
       POP  DE         ;BC, DE & HL, to addresses of     D1
       POP  HL         ;variables.                       E1
       POP  IX         ;Restore index registers.         DD E1
       POP  IY         ;                                 FD E1
       RET             ;Exit arithmetic suite.           C9
;=============================================================
```

DATASHEET 2

```
;= ADDX   - 32-bit signed integer addition.
;= SUBX   - 32-bit signed integer subtraction.
;= CMPX   - 32-bit signed integer comparison.
;=============================================================
;JOB         32-bit (sign bit + 31-bit magnitude) addition,
;            subtraction and comparison.
;ACTION      See individual routine comments.
;-------------------------------------------------------------
;CPU         Z80
;HARDWARE    Variables in RAM.
;SOFTWARE    XENTRY, XEXIT, RESTOR, EXDH, NEGH, ADDHB, SUBHB.
;-------------------------------------------------------------
;INPUT       ADDX/SUBX: Three variables at (HL), (DE) & (BC).
;            CMPX:      Two variables at (DE) & (BC).
;OUTPUT      ADDX/SUBX: Cy=1: magnitude overflow.
;                       Cy=0: (HL) = (DE) + or - (BC).
;                             S, Z return sign & zero status.
;            CMPX:      Z=1: Cy=0:  (DE) = (BC)
;                       Z=0: Cy=0:  (DE) > (BC)
;                       Z=0: Cy=1:  (DE) < (BC)
;ERRORS      None.
;REG USE     F BC DE HL
;STACK USE   26
;RAM USE     None.
;LENGTH      ADDX/SUBX: 38.  CMPX: 32.
;CYCLES      Not given.
;-------------------------------------------------------------
;CLASS 2      *discreet       -interruptable      *promable
;*-**-*       *reentrant      -relocatable        *robust
;=============================================================
;
ADDX   CALL XENTRY     ;Save regs. & get arguments.      CD lo hi
       JR   ASX        ;Go to common ADD/SUB code.       18 05
;
SUBX   CALL XENTRY     ;Save regs. & get arguments.      CD lo hi
       XOR  80H        ;Complement XOR sign for sub.     EE 80
;
ASX    CALL EXDH       ;Move 1st argument to HLHL'.      CD lo hi
       RLA             ;Get XOR sign, arg1 sign to 7,A.  17
       JR   C,ASSUB    ;Subtract if signs different.     38 09
;
       CALL ADDHB      ;Add magnitudes arg2 to arg1.     CD lo hi
       RLC  H          ;Bit 7,H set if overflow, so      CB 04
       SRL  H          ;convert to Cy & clear 7,H.       CB 3C
       JR   SAXEND     ;Go exit, store if no carry.      18 0A

ASSUB  CALL SUBHB      ;Sub magnitudes arg2 from arg1.   CD lo hi
       JR   NC,SAXEND  ;Exit okay if sub went.           30 05
       CALL NEGH       ;Else negate and swap result      CD lo hi
       XOR  80H        ;sign, clearing Cy.               EE 80
;
SAXEND JMP  XEXIT      ;Exit, add or sub done.           C3 lo hi
;
;-------------------------------------------------------------
;
CMPX   CALL XENTRY     ;Save regs. & get arguments.      CD lo hi
       RLA             ;Get arguments XOR sign           17
       JR   NC,CXSE    ;and skip if signs are equal.     30 03
;
       RL   A          ;Signs different, sign arg1 gives CB 17
       JR   CXEND      ;correct Cy result, Z reset.      18 13
;
CXSE   CALL EXDH       ;Move 1st argument to HLHL'.      CD lo hi
       CALL SUBHB      ;Sub magnitudes arg2 from arg1.   CD lo hi
       RLA             ;Arg1 sign to Cy, sub result sign 17
       ADC  A,0        ;sign to 1,A. Change result sign  CE 00
       OR   0FEH       ;if arg1 -ve & set before mask.   F6 FE
       CALL NEGH       ;Get Cy=0 only if HLHL' is zero   CD lo hi
       SBC  HL,HL      ;Propogate Z status through H     ED 62
       AND  H          ;reset all bits if HLHL' was 0    A4
       RR   A          ;and set correct Cy and Z flags.  CB 1F
;
CXEND  JMP  RESTOR     ;Exit returning flags only.       C3 lo hi
;=============================================================
```

DATASHEET 3

```
;= MULX   - 32-bit signed multiplication.
;> MULSUB - 31-bit magnitude multiplication.
;=============================================================
;JOB         32-bit (sign bit + 31-bit magnitude) multiplication.
;ACTION      Binary long multiplication (see comments).
;-------------------------------------------------------------
;CPU         Z80
;HARDWARE    Variables in RAM.
;SOFTWARE    XENTRY, XEXIT, LWRLD, LWRLH, ADDHB.
;-------------------------------------------------------------
;INPUT       MULX:    Three variables at (HL), (DE) & (BC).
;            MULSUB:  Two 31-bit magnitudes in DEDE' & BCBC'
;                     HLHL' = 0.
;OUTPUT      MULX:    Cy=1: magnitude overflow.
;                     Cy=0: (HL) = (DE) * (BC).
;                           S, Z return sign & zero status.
;            MULSUB:  S=1:  overflow.
;                     S=0:  HLHL' = DEDE' * BCBC'.  DEDE' = 0.
;ERRORS      None.
;REG USE     MULX:    F BC DE HL
;            MULSUB:  F BCDEHL AF' BCDEHL'
;STACK USE   MULX: 26.  MULSUB: 2.
;RAM USE     None.
;LENGTH      MULX: 13.  MULSUB: 27.
;CYCLES      Not given.
```

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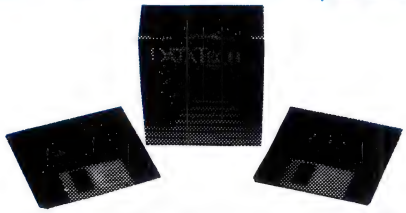

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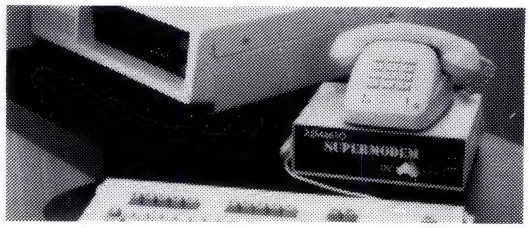

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```
;-------------------------------------------------------------------------
;CLASS 2      *discreet       -interruptable      *promable
;*-**-*       *reentrant      -relocatable        *robust
;-------------------------------------------------------------------------
;
MULX    CALL XENTRY     ;Save regs. & get arguments.        CD lo hi
        CALL MULSUB     ;Do magnitude multiplication.       CD lo hi
        RLC  H          ;Bit 7,H set if overflow, so        CB 04
        SRL  H          ;convert to Cy & clear 7,H.         CB 3C
        JMP  XEXIT      ;Exit, storing product if Cy=0.     C3 lo hi
;
;-------------------------------------------------------------------------
;
MULSUB OR   A           ;Clear Cy and shift multiplier      B7
       CALL LWRLD       ;magnitude up to highest bits.      CD lo hi
       EX   AF,AF'      ;Access alternate accumulator       08
       LD   A,31        ;set 31-bit multiplier count.       3E 1F
;
MSLOOP EX   AF,AF'      ;Access normal flags.               08
       CALL LWRLH       ;Product to next bit place.         CD lo hi
       RET  M           ;Exit S=1 if 31-bit overflow.       F8
       CALL LWRLD       ;Get next multiplier bit,           CD lo hi
       JR   NC,MSLT     ;skip if not set else add           30 03
       CALL ADDHB       ;multiplicand at this bit place     CD lo hi
       RET  M           ;but exit S=1 if overflow.          F8
MSLT   EX   AF,AF'      ;Access count in A'.                08
       DEC  A           ;Count off this bit place done      3D
       JR   NZ,MSLOOP   ;and repeat until product.          20 EE
;
       EX   AF,AF'      ;Access normal AF and exit with     08
       RET              ;HLHL'product, DEDE'=0, S=0.        C9
;-------------------------------------------------------------------------
```

DATASHEET 4

```
;-------------------------------------------------------------------------
;= DIVX   - 32-bit signed integer division.
;= MODX   - 32-bit signed modulus (division remainder).
;> DIVSUB - 31-bit magnitude division (integer & remainder).
;-------------------------------------------------------------------------
;JOB         32-bit (sign bit + 31-bit magnitude) division
;           quotient or division remainder.
;ACTION      Binary long division (see comments).
;-------------------------------------------------------------------------
;CPU         Z80
;HARDWARE    Variables in RAM.
;SOFTWARE    XENTRY, XEXIT, LWRLD, LWRLH, ADDHB, SUBHB, CLRH,
;           EXDH.
;-------------------------------------------------------------------------
;INPUT       DIVX/MODX:   Three variables at (HL), (DE) & (BC).
;           DIVSUB:      Two 31-bit magnitudes in DEDE' & BCBC'
;                        HLHL' = 0.
;OUTPUT      DIVX:   Cy=1: division by zero.
;                    Cy=0: (HL) = integer quotient (DE) / (BC).
;                          S, Z return sign & zero status.
;           MODX:   Cy=1: division by zero.
;                    Cy=0: (HL) = integer remainder (DE) / (BC).
;                          S, Z return sign & zero status.
;           DIVSUB: Cy=1:  division by zero
;                    Cy=0:  DEDE' remainder HLHL'= DEDE' / BCBC'.
;ERRORS      None.
;REG USE     DIVX/MODX: F BC DE HL
;           DIVSUB:    F BCDEHL AF' BCDEHL'
;STACK USE   DIVX: 26.  MODX: 26.  DIVSUB: 2.
;RAM USE     None.
;LENGTH      DIVX: 12.  MODX: 10.  DIVSUB: 36.
;CYCLES      Not given.
;-------------------------------------------------------------------------
;CLASS 2      *discreet       -interruptable      *promable
;*-**-*       *reentrant      -relocatable        *robust
;-------------------------------------------------------------------------
;
DIVX    CALL XENTRY     ;Save regs. & get arguments.        CD lo hi
        CALL DIVSUB     ;Do magnitude division.             CD lo hi
        CALL EXDH       ;Move quotient to HLHL'             CD lo hi
        JMP  XEXIT      ;Exit, storing quotient if Cy=0.    C3 lo hi
;
;-------------------------------------------------------------------------
;
MODX    CALL XENTRY     ;Save regs. & get arguments.        CD lo hi
        RLA             ;Get remainder sign to 7,A.         17
        CALL DIVSUB     ;Do magnitude division.             CD lo hi
        JMP  XEXIT      ;Exit, storing remainder if Cy=0.   C3 lo hi
;
;-------------------------------------------------------------------------
;
DIVSUB CALL SUBHB       ;Sub will reset Cy if divisor       CD lo hi
       CCF              ;is zero, so swap Cy state and      3F
       RET  C           ;exit early if division by 0.       D8
;
       CALL CLRH        ;Re-zeroise remainder, HLHL'.       CD lo hi
       EX   AF,AF'      ;Access alternate accumulator       08
       LD   A,31        ;and set quotient count in A'.      3E 1F
       OR   A           ;Clear Cy and shift d'dend up       B7
       CALL LWRLD       ;to highest bit of DEDE' then       CD lo hi
       CALL LWRLD       ;shift out first d'dend to Cy.      CD lo hi
;
DSLOOP CALL LWRLH       ;Shift next bit to remainder        CD lo hi
       CALL SUBHB       ;and try to subtract divisor        CD lo hi
       CALL C,ADDHB     ;add back if won't go and set       DC lo hi
       CCF              ;Cy for result. Shift in result     3F
       CALL LWRLD       ;bit and get next dividend bit.     CD lo hi
       DEC  A           ;Repeat for 31-bit quotient         3D
       JR   NZ,DSLOOP   ;leaving 31-bit remainder           20 F0
;
       EX   AF,AF'      ;Access normal AF.                  08
DSEND  RET              ;Exit, DEDE' quot., HLHL' rem.      C9
;-------------------------------------------------------------------------
```

DATASHEET 5

```
;=============================================================
;= SQX     - 32-bit signed square.
;> SQSUB   - 31-bit magnitude square.
;-------------------------------------------------------------
;JOB        32-bit (sign bit + 31-bit magnitude) square.
;ACTION     Binary long multiplication (see comments).
;-------------------------------------------------------------
;CPU        Z80
;HARDWARE   Variables in RAM.
;SOFTWARE   XENTRY, XEXIT.
;-------------------------------------------------------------
;INPUT      SQX:   Two variables at (HL) & (DE).
;           SQSUB: 31-bit magnitude in DEDE'.
;                  HLHL' = 0.
;OUTPUT     SQX:   Cy=1: magnitude overflow.
;                  Cy=0: (HL) = (DE)^2.
;                        S, Z return sign & zero status.
;           SQSUB: S=1:  magnitude overflow.
;                  S=0:  HLHL'= DEDE'^2.  DEDE' unchanged.
;ERRORS     None.
;REG USE    SQX:   F DE HL
;           SQSUB: F DEHL DEHL'
;STACK USE  SQX: 26.  SQSUB: 2.
;RAM USE    None.
;LENGTH     SQX: 10.  SQSUB: 23.
;CYCLES     Not given.
;-------------------------------------------------------------
;CLASS 2     *discreet      -interruptable     *promable
;*-**-*      *reentrant     -relocatable       *robust
;=============================================================
;
SQX     CALL XENTRY     ;Save regs. & get root in DEDE'.   CD lo hi
        XOR  A          ;Clear sign, squares positive.     AF
        CALL SQSUB      ;Square magnitude and exit         CD lo hi
        JMP  XEXIT      ;storing square if Cy=0.           C3 lo hi
;
;-------------------------------------------------------------
;
SQSUB   OR   A          ;Clear Cy, negate root hi-word     B7
        SBC  HL,DE      ;setting S only if word>0. Exit    ED 52
        RET  M          ;S=1 if square will overflow.      F8
;
        EXX             ;Access alternate regs.            D9
        PUSH DE         ;and get 16-bit root, DE'.         D5
        EXX             ;Access normal regs. and get       D9
        POP  HL         ;root in HL as multiplier.         E1
        LD   D,16       ;Set 16-bit multiplier count.      16 10
;
SQLP    ADC  HL,HL      ;Next m'plier out, product in.     ED 6A
        JR   NC,SQLT    ;Skip if no add this bit place.    30 03
        EXX             ;Else access alternate regs. and   D9
        ADD  HL,DE      ;add m'cand to product lo-word.    19
        EXX             ;Access normal regs.               D9
SQLT    DEC  D          ;Count off one multiplier bit      15
        JR   NZ,SQLP    ;and repeat for 16-bits.           20 F6
;
        ADC  HL,HL      ;Final Cy to product hi-word.      ED 6A
        RET             ;Exit, HLHL square, DEDE' root.    C9
```

DATASHEET 6

```
;=============================================================
;> CLRH   - Clear 32-bit accumulator.
;> NEGH   - Negate (2s complement) 32-bit accumulator.
;> EXDH   - Swap 32-bit register DEDE & 32-bit accumulator.
;> ADDHB  - Add register BCBC to accumulator.
;> SUBHB  - Subtract register BCBC from accumulator.
;> LWRLD  - Rotate left register DEDE.
;> LWRLH  - Rotate left accumulator.
;> LWSLAX - Arithmetic shift left register IXIY.
;-------------------------------------------------------------
;JOB        Manipulation of 32-bit registers.
;ACTION     See individual routine comments.
;-------------------------------------------------------------
;CPU        Z80
;HARDWARE   None.
;SOFTWARE   None.
;-------------------------------------------------------------
;INPUT      32-bit values in named registers (see routines).
;           Cy flag status in rotate operations.
;OUTPUT     32-bit values in named registers (see routines).
;           Cy from arithmetic, shift and rotate operations.
;ERRORS     None.
;REG USE    F BCDEHL BCDEHL' IX IY (see individual routines).
;STACK USE  None.
;RAM USE    None.
;LENGTH     (73)  CLRH: 9.  NEGH: 16.  EXDH: 5.  ADDHB:  6.
;                 SUBHB: 8.  LWRLD: 11.  LWRLH: 7.  LWSLAX: 11.
;CYCLES     Not given.
;-------------------------------------------------------------
;CLASS 2     *discreet      *interruptable     *promable
;*****-      *reentrant     *relocatable       -robust
;=============================================================
;
CLRH    LD   HL,0       ;Clear hi-word.                    21 00 00
        EXX             ;Access alternate regs.            D9
        LD   HL,0       ;Clear lo-word.                    21 00 00
        EXX             ;Access normal regs.               D9
        RET             ;Exit, HLHL' = 0.                  C9
;
;-------------------------------------------------------------
;
```

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```
;
;...2nd change.
;...REPLACE 4-byte, 2-instructions "LDA FCB1+32" and "MOV B,A"
;...at location 0225 (March routine) by 5-byte, 3-instructions:-
;
        LHLD FCB1+33  ;Get sector count for write.      2A 7D 00
        MOV  C,L      ;Move into BC for count.         4D
        MOV  B,H      ;                                44
;
;...3rd change.
;...REPLACE 1-byte, 1-instruction "DCR B" at location 0247
;...(March routine) by 3-byte, 3-instructions:-
;
        DCX  B        ;16-bit decrement write count.   0B
        MOV  A,C      ;check 16-bit count for zero.    79
        ORA  B        ;                                B0
;
```

Fig 1

6502 LARGE DIVISION

DINVAR (datasheet eight), from Adrian Taylor, performs unsigned division on dividends up to 256 bytes long. The divisor, however, is limited to a mere four bytes.

Adrian wrote the routine while experimenting with hashing procedures, and needed a fast remainder-only division (MOD) that would leave the dividend intact. The ASCII strings corresponding to long variable or file names can be divided by a suitable prime to give a two or four-byte hash reference number for quicker table searches.

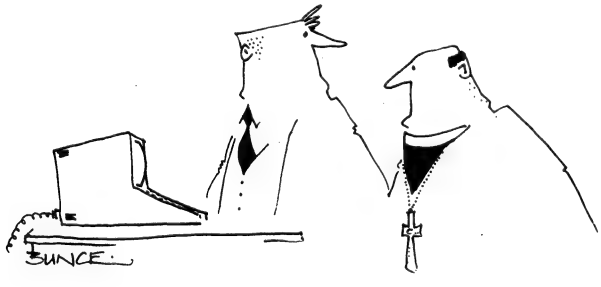
As written, DINVAR also returns the quotient. The original remainder-only version can be recovered by omitting the instructions 'ADC #0', which sets the result bit in the current byte; and 'STA (QTPNT),Y', which writes the completed byte to quotient space in memory. An alternative version could overwrite the dividend by the quotient.

Adrian has tested the routine with a 6522 VIA timer on 100,000 pseudo-random divisions to produce sample timings for divisors of from one to four bytes. Interestingly, larger divisors perform better — presumably because less comparison is required, on average, than with shorter divisors. The 256-byte by one-bit division time is presumed to be the maximum operating time of the routine.

DATASHEET 8

```
:═══════════════════════════════════════════════════════════
:= DINVAR - 1-byte to 256-byte by 4-byte division.
:═══════════════════════════════════════════════════════════
:JOB        To divide an unsigned binary integer, from 1 to 256
:           bytes in length and stored least-significant-byte in
:           lowest address, by an unsigned divisor of up to
:           32-bit precision, returning a 4-byte remainder and
:           a quotient of equal length to the dividend.
:ACTION     ON remainder overflow [ Set fail flag and exit ]
:           IF divisor = 0
:           THEN [ Set fail flag and exit. ]
:           ELSE [ Clear 32-bit remainder.
:                  FOR dividend & quotient ms to ls bytes
:                  [ Read next dividend byte.
:                    FOR dividend byte 8-bit count
:                    [ Shift dividend byte bit into remainder,
:                      clearing next quotient result bit.
:                      IF remainder >= divisor THEN
:                      [ Remainder = remainder - divisor.
:                        Set quotient result bit. ] ]
:                    Write quotient byte. ]
:                  Clear fail flag and exit. ]
:─────────────────────────────────────────────────────────────
:CPU        6502
:HARDWARE   Equal length dividend and quotient RAM.
:SOFTWARE   None.
:─────────────────────────────────────────────────────────────
:INPUT      M4,5 = pointer to dividend in memory.
:           MF   = dividend byte length ($01 to $00=256).
:           M6,7 = pointer to quotient in memory.
:           M8-B = 32-bit divisor.
:           Quotient space must equal dividend space.
:           Dividend must be stored with most significant byte
:           in highest address.
:OUTPUT     All registers changed, M0-3 changed,
:           other page zero locations unchanged.
:           C=0: Division completed.
:                Quotient in quotient space (ms-byte in hi-mem).
:                M0-3 = 32-bit remainder.
:           C=1: Division failed (zero divisor, overflow).
:                M0-3 and quotient space = ?
```

```
:ERRORS      No check for quotient overwrite of dividend.
:REG USE     P A X Y
:STACK USE   1
:RAM USE     M0-MB, MF.
:LENGTH      115
:CYCLES      Average timing (by VIA) for 100,000 pseudo-random
:            value DINVAR divisions. 4-byte dividend by
:                        4-byte   3-byte  2-byte  1-byte  divisor
:            cycles:      1645     2140    2639    3090
:            Maximum (256-byte / 1-bit):  240,671 cycles.
:-------------------------------------------------------------
:CLASS 2      -discreet       *interruptable       *promable
:-****-       *reentrant      *relocatable         -robust
:=============================================================
:
REMA   =    M0          :M0-M3, 4-byte remainder accumulator.
DDPNT  =    M4          :M4,M5, 2-byte pointer to dividend.
QTPNT  =    M6          :M6,M7, 2-byte pointer to quotient.
DSOR   =    M8          :M8-MB, 4-byte divisor.
DDLEN  =    MF          :MF,    1-byte dividend byte length.
:
DINVAR LDA  DSOR+0      :Test divisor for zero.              A5 M8
       ORA  DSOR+1      :                                    05 M9
       ORA  DSOR+2      :                                    05 MA
       ORA  DSOR+3      :If zero then                        05 MB
       BEQ  FAIL        :exit, C set, division by zero.      F0 68
:
       LDA  #0          :Using A,                            A9 00
       STA  REMA+0      :Clear 4-byte remainder              85 M0
       STA  REMA+1      :accumulator.                        85 M1
       STA  REMA+2      :                                    85 M2
       STA  REMA+3      :                                    85 M3
:
       LDY  DDLEN       :Get dividend byte length (00 = 256) A4 MF
       DEY              :and convert to index (0 to 255).    88
:
DIV1   LDA  (DDPNT),Y   :Get next dividend byte to A.        B1 M4
       LDX  #8          :8-bit count in X.                   A2 08
:
DIV2   ASL  A           :Shift next dividend bit out of A    0A
       ROL  REMA+0      :and into remainder, shifting        26 M0
       ROL  REMA+1      :remainder up to accommodate.        26 M1
       ROL  REMA+2      :                                    26 M2
       ROL  REMA+3      :If C=1 then remainder overflow      26 M3
       BCS  FAIL        :so exit, C set.                     B0 4C
:
       PHA              :Save dividend--quotient byte.       48
:
TRY3   LDA  REMA+3      :Begin at ms-byte, compare           A5 M3
       CMP  DSOR+3      :divisor with current remainder,     C5 MB
       BCC  DIV4        :skip subtraction if d'sor too big,  90 36
       BEQ  TRY2        :compare next bytes if same,         F0 02
       BCS  DIV3        :subtract if divisor smaller.        B0 1A
:
TRY2   LDA  REMA+2      :Repeat with next significant        A5 M2
       CMP  DSOR+2      :byte if necessary.                  C5 MA
       BCC  DIV4        :                                    90 2C
       BEQ  TRY1        :                                    F0 02
       BCS  DIV3        :                                    B0 10
:
TRY1   LDA  REMA+1      :Repeat with next significant        A5 M1
       CMP  DSOR+1      :byte if necessary.                  C5 M9
       BCC  DIV4        :                                    90 22
       BEQ  TRY0        :                                    F0 02
       BCS  DIV3        :                                    B0 06
:
TRY0   LDA  REMA+0      :Repeat with least significant       A5 M0
       CMP  DSOR+0      :byte if necessary.                  C5 M8
       BCC  DIV4        :                                    90 18
:
DIV3   LDA  REMA+0      :With C=1 from comparison, subtract  A5 M0
       SBC  DSOR+0      :divisor least significant byte      E5 M8
       STA  REMA+0      :from remainder.                     85 M0
:
       LDA  REMA+1      :Continue for 4-byte subtraction...  A5 M1
       SBC  DSOR+1      :                                    E5 M9
       STA  REMA+1      :                                    85 M1
:
       LDA  REMA+2      :                                    A5 M2
       SBC  DSOR+2      :                                    E5 MA
       STA  REMA+2      :                                    85 M2
:
       LDA  REMA+3      :                                    A5 M3
       SBC  DSOR+3      :... leaving C=1 to show             E5 MB
       STA  REMA+3      :subtraction gone okay.              85 M3
:
DIV4   PLA              :restore dividend--quotient byte     68
       ADC  #0          :& add in quotient result bit.       69 00
       DEX              :Repeat for 8 bits of d'dend to      CA
       BNE  DIV2        :give 8-bit partial quotient.        D0 B2
:
       STA  (QTPNT),Y   :Store quotient byte to correct      91 M6
       DEY              :place. count off one byte done      88
       CPY  #$FF        :and test for all dividend done      C0 FF
       BNE  DIV1        :repeating until quotient found.     D0 A7
:
       CLC              :C=0 to show division done           18
       RTS              :and exit.                           60
:
FAIL   SEC              :C=1 to show division failed         38
       RTS              :and exit.                           60
:=============================================================
```



'Certainly sir — you can program it to believe in absolutely anything!'

68000 MATRIX TRANSPOSITION

TRN68K (datasheet nine) has been submitted by Paul Cowper as a matrix rotation. However, instead of merely turning the 8-bit square matrix around by 90 degrees, the routine performs a 'flip' about one of the diagonals.

Matrix rotations are useful in graphics applications, but small transpositions such as TRN68K seem only to have use in arranging character bit patterns for Epson-standard printers in bit image mode.

All that is needed to convert the routine to a rotation is to shift bits out from the low-order end of the source bytes rather than the high-order end. Perhaps this is not so easy in 68000 code, which seems to get bogged down when manipulating single bytes in memory.

END

DATASHEET 9

```
:=============================================================
:= ROT68K -     Transpose an 8-bit by 8-bit character matrix.
:=============================================================
:JOB            To transpose an 8-bit by 8-bit matrix, stored as
:               eight contiguous bytes.
:ACTION         FOR each bit (7 to 0)
:               [ FOR each byte (0 to 7)
:                 [ Shift left 64-bit accumulator...byte. ] ]
:               Write accumulator to source.
:-------------------------------------------------------------
:CPU            68000 series.
:HARDWARE       8 bytes matrix RAM.
:SOFTWARE       None.
:-------------------------------------------------------------
:INPUT          A0 addresses source matrix (lowest address).
:OUTPUT         Matrix transposed.
:               CCR changed. All other registers unchanged.
:ERRORS         None.
:REG USE        A0 CCR
:STACK USE      (A7): 24
:RAM USE        None.
:LENGTH         38
:CYCLES         3288
:-------------------------------------------------------------
:CLASS 2        -discreet       *interruptable       *promable
:-*****         *reentrant      *relocatable         *robust
:=============================================================
:
TRN68K MOVEM.L D0-D4/A1,-(A7) :Save working regs.            48E7
                              :                              F840
       MOVEA.L A0,A1          :Save source point to A1.      2248
       MOVEQ   #7,D0          :Source bits/byte count.       7007
:
T68K1  MOVEQ   #7,D1          :Source byte count.            7207
:
T68K2  MOVE.B  (A0),D2        :Add copy of source byte to    1410
       ADD.B   D2,(A0)+       :effect a byte left shift.     D518
       ADDX.L  D4,D4          :Rotate bit through 64-bit     D984
       ADDX.L  D3,D3          :temp dest, D3D4.              D783
       DBF     D1,T68K2       :Repeat for 1 bit from each    51C9
                              :of 8 source bytes.            FFF6
:
       MOVEA.L A1,A0          :Reset source point to start.  2049
       DBF     D0,T68K1       :Repeat for 8 bits from        51C8
                              :every byte.                   FFEE
:
       MOVEM.L D3/D4,(A0)     :Then store turned matrix      48D0
                              :from D3D4 to source memory.   0018
       MOVEM.L (A7)+,D0-D4/A1 :Restore working regs.         4CDF
                              :                              021F
       RTS                    :Exit, matrix transposed.      4E75
:=============================================================
```

How long is a farey tale? This month Mike Mudge examines the construction and use of Farey Sequences.

Definition The Farey Sequence, F_n, of order n is the ascending sequence of irreducible fractions between 0 and 1 whose denominators do not exceed n; the numbers 0 and 1 are included in the forms 0/1 and 1/1. For example, F_5 is: 0/1, 1/5, 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 1/1.

Notes:

(i) The fraction 1/2 is the middle term of every Farey Sequence.

(ii) Two terms equidistant from the middle have a sum of unity. This property can be readily used to economise on the presentation of F_n, thus we write F_5:

0 1 1 1 2 1
1 5 4 3 5 2
1 4 3 2 3 1

(iii) Clearly if m is any number smaller than n, the sequence F_m consists simply of those terms of F_n whose denominators are not larger than m, in unchanged order.

(iv) The sequence F_n exhibits, incidentally, for every value of m not larger than n, the sequence of numbers prime to m and not larger than n. The numbers prime to m and smaller than m are in ascending order the numerators which have m for denominator, while the numbers prime to m and larger than m are in descending order the denominators which have m for numerator.

Theorem The total number of terms in F_n is PHI(n) + 1 where PHI(n) is the sum-function of Euler's Totient Function phi(n). For definitions of these functions see 'Numbers Count' June 1985.

Historical Notes Farey Sequences are implicit in Henry Goodwyn's *A Tabular Series of Decimal quotients* (London, 1823) and an earlier volume by the same author (1818); also in tables published by Achille Brocot in Paris in 1862; these are of order 100.

This value was not passed until 1935 when E Buckingham's *Manual of Gear Design* included an unreliable and incomplete table of F_{120}. This was corrected in RM Page's *14000 Gear Ratios* (1942); however, the 'ultimate' table of F_{1025} was designed and compiled by EH Neville and published for The Royal Society by The University of Cambridge Press in 1950. Here the 319765 terms are elegantly presented 400 to a page, 20 to a line.

Problem A Write a computer program to generate and display in a meaningful manner F_n, for a given n. Warning: do *not* attempt to reproduce Neville's table in full, although computation time would be an interesting parameter.

Problem B Devise and implement an efficient routine for locating a given term in F_n.

Note: Except for small values of n, the fractions 1/b, 2/b, 3/b, ... (b-1)/b divide F_n into subsequences, almost all of which contain approximately the same number of terms.

Would your routine be suitable for 'manual' implementation given printed tables?

Problem C Devise and implement a routine for inserting between two terms of a given Farey Sequence a batch of terms belonging to a Farey Sequence of a higher order.

Investigate the use of such a routine to generate rational approximations to say 'pi' or 'e'.

Problem D Observing that the application of Farey Sequences to the solution of the linear Diophantine Equation $Bx - ay = 1$ depends upon the result that if a/b and c/d are consecutive terms in F_n, then $bc - ad = 1$, and conversely that if $bc - ad = 1$, then a/b and c/d are consecutive in F_n for all values of n from max (b,d) to b+d−1, investigate the use of 'instore' Farey Sequences to solve such equations.

Readers are invited to submit their attempts at some (or all) of the above problems to Mike Mudge, C/- *APC*, 2nd Floor, 215 Clarence Street, Sydney 2000.

It would be appreciated if such submissions could contain a brief summary of results obtained and thoughts relating to the problem in a form suitable for future publication in *APC*. Submissions, which must reach me by 15 October 1986, will be judged using suitably vague criteria, and a prize will be awarded to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided. Expanded reviews of previous problems, together with, subject to the approval of the contributor, copies of detailed programs from the winning entry may also be requested. Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computationally related mathematics, particularly containing suggested subject areas for future Numbers Count articles, and will endeavour to reply to all letters.

March review

Those readers who were frightened off by the mathematics of primitive roots and indices are referred to *Elementary Number Theory* by Allan M Kirch, Intext Educational Publishers 1974, where some simple Basic programs are given to find, for example, the smallest primitive root of a given odd prime, and then to generate a table of indices and anti-indices.

Tables suitable for checking the correctness of routines are to be found in *An Introduction to the Theory of Numbers* by IM Vinogradov, Pergamon 1955; the theory of primitive roots is developed historically in LE Dickson's *History of the Theory of Numbers* volume 1, Chelsea, New York 1952, while some difficult mathematical examples are to be found in *Exercises in Number Theory* by DP Parent, Springer-Verlag 1984.

Responses to this problem included several very detailed and extremely well-presented pieces of work, but after careful consideration the prize winner is Dr John Cohn.

John chose to write in Basic on his PET in preference to his Amstrad 8256 which he believes has certain bugs associated with its Basic.

Following the input of N, checked to be a positive integer less than 10000 and of the required form, the program then offers the following choices:

(1) to find all primitive roots;
(2) to find the least primitive root only;
(3) to find a table of indices wrt the least primitive root; and
(4) to find a table of indices wrt any supplied primitive root.

John's routines should run on almost any machine given adequate memory; about 23k is needed in the worst case, the conscious decision being taken to save execution time by using memory to avoid long sorting routines; hence the restriction N less than 10000.

END

Prepare yourself for the computer chess champion of the 21st century. Kevin O'Connell reports on a game between Kasparov and Turbostar.

At the end of last year I witnessed a game from a simultaneous display given by the Dutch Grandmaster Genna Sosonko against 31 computers. He had a hard time against the machines and lost five games.

As a reminder that it is not always plain sailing for the computers, and as an indication of how far we have yet to go before we might see an electronic world chess champion, I am now going to show you a game from a simultaneous display against 32 computers given by Garry Kasparov not long before he became World Champion. Kasparov had some difficulties, but in the end the score line was 32-0.

Although no computer is yet even near to being a match for Kasparov, they are making very steady progress and a chart of significant computer results against human opposition suggests that at least one computer should register at least one tournament result in the Kasparov class before the end of the millenium.

White: Kasparov. Black: Turbostar 432. Opening: Reti Opening.

1	c2–c4	e7–e6
2	g2–g3	Ng8–f6
3	Bf1–g2	d7–d5
4	Ng1–f3	d5xc4
5	O–O	c7–c6
6	a2–a4	Bf8–e7
7	Qd1–c2	Nb8–d7
8	Qc2xc4	Nd7–b6
9	Qc4–c2	Nf6–d5
10	Nb1–c3	Nd5–b4
11	Qc2–d1	O–O

White does not seem to have been doing anything very much, but, in fact, he has full control of the centre, which he now occupies.

12	d2–d4	a7–a5
13	e2–e4	Bc8–d7
14	Qd1–e2	Bd7–e8
15	Rf1–d1	
15	...	f7–f6

Rather weakening, but otherwise Black can barely move anything.

16	Bc1–e3	Be8–h5
17	h2–h3	f6–f5

To prevent g3–g4.

18	Be3–f4	Qd8–d7
19	Rd1–e1	Bh5xf3
20	Bg2xf3	Be7–d6

After 20 ... QD7xd4, 21 e4xf5 gets White's pawn back and gives tremendous pressure — practically all his pieces suddenly occupying dominating positions on open lines.

21	Bf4xd6	Qd7xd6
22	Ra1–d1	f5–f4
23	g3–g4	

This leaves White's bishop very little scope, but then, as compensation, computers usually play blocked positions very badly.

23	...	Ra8–d8
24	Rd1–d2	e6–e5
25	d4–d5	

Yet another white pawn goes onto a white square, almost entombing the bishop.

25	...	h7–h6
26	Re1–d1	c6–c5
27	Qe2–b5	Rd8–a8
28	Qb5–f1	Qd6–d7
29	b2–b3	
29	...	c5–c4!

An excellent break.

30	b3xc4	Ra8–c8
31	g4–g5	Nb6xc4
32	Rd2–a2	

Rd2–e2 maintains the material equilibrium, but leaves White with a horrible position to defend. Kasparov much prefers to attack, which he does here most ingeniously.

32	...	Nb4xa2
33	Nc3xa2	Qd7xa4
34	g5xh6	Qa4xa2

At the cost of a rook Kasparov has pulled the black queen offside and has generated some attack against the black king.

35	Qf1–g2	Rc8–c7
36	d5–d6	Rc7–d7
37	Bf3–g4	
37	...	Qa2–b3?

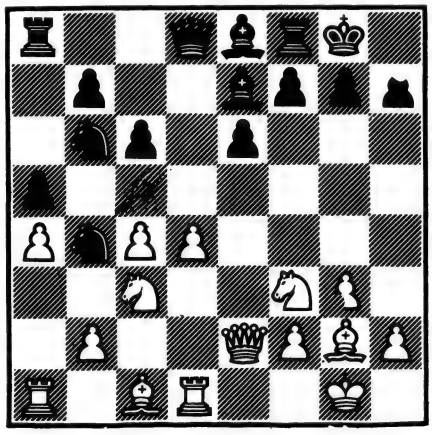
Following the standard precept 'when ahead exchange pieces', but this is a mistake. It would have been much better to offer to give back some of the material, playing 37 ... Qa2–a4, to get the queen back into the game.

38	Bg4xd7	Qb3xd1+
39	Kg1–h2	Rf8–f7
40	Bd7–e6	Kg8–f8
41	h6–h7	

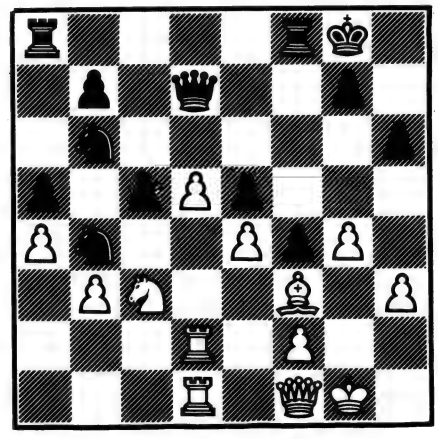
Now it is all over.

41	...	Nc4xd6
42	h7–h8=Q+	Kf8–e7
43	Be6xf7	Nd6xf7
44	Qh8xg7	1-0 (Black resigned)

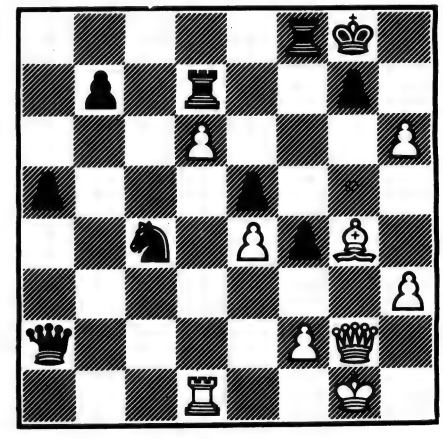
END



15 Rf1–d1 ..... f7f6



29 b2b3 ..... c5–c4!



37 Bf3–g4 ..... Qa2–b3?

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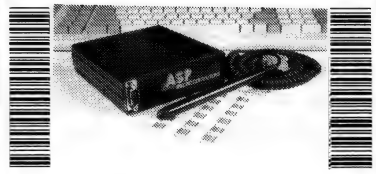

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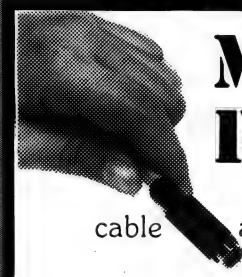

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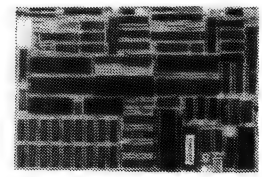

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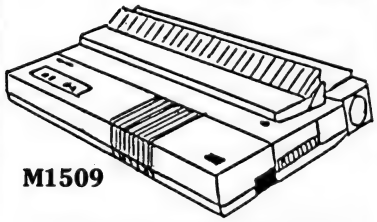

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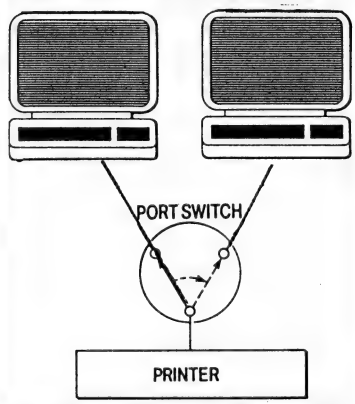

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BENCHMARKS

A list of Benchmarks used when evaluating micros is given below. An explanation can be found in the February '84 issue.

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END

100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END

100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END

100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN

100 REM Benchmark 6
110 PRINT "S"
120 K=0
```

```
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GUSUB220
170 FORL=1 TO 5
180 NEXTL
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN

100 REM Benchmark7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190 NEXTL
200 IF K<1000 THEN 140
210 PRINT "E"
```

```
220 END
230 RETURN

100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K  2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

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Munich, Germany	8th International Conference on Computer Communication. Contact: ICCC '86, C/- PO Box 900429, D-8000, Munich 90, West Germany	September 15-19, 1986
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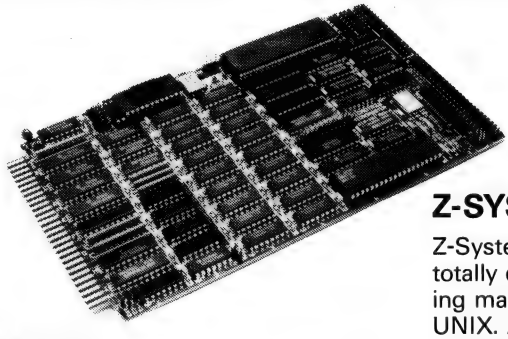

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LAZING AROUND

Brain teasers courtesy of JJ Clessa.

A friend of mine has just had a birthday. If he multiplies the two digits of his age in years, and doubles the result, the answer comes to one less than his age. How old is he?

Prize puzzle

This problem can be solved fairly easily by analytical methods. But if you can't manage that, then it shouldn't be too difficult to write a computer program to do the trick.

(1) There are three numbers (5, 7, and 11) which have no factors in common (except unity) with the number 12.

(2) There are seven numbers (3, 7, 9, 11, 13, 17, and 19) which have no factors in common (except unity) with the number 20.

(3) How many numbers are there which have no factors in common (except unity) with the number 720?

There's no need to list the numbers — just tell me how many there are.

Answers, on postcards only please, to reach *APC*, 2nd Floor, 215 Clarence Street, Sydney 2000, no later than October 15, 1986.

June prize puzzle

Although the problem was slightly harder than usual to program, it had rather more solutions than we anticipated — about 400 or so more! Perhaps that explains why there were less than 50 submissions.

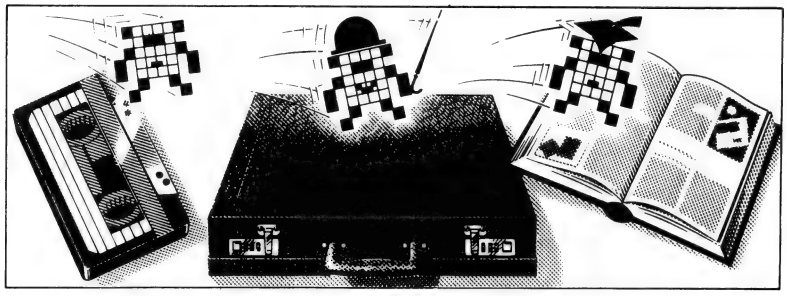
We accepted any valid entry that matched the requirements:

The lowest was 124 739 586 with a divisor of 3.

The highest was 785 926 314 with a divisor of 9 and there were hundreds in between.

The winning entry, chosen at random, came from K Mackie of Wentworthville NSW. Congratulations, your prize is on its way.

PROGRAM FILE



- ***Games***
- ***Scientific/mathematic***
- ***Business***
- ***Toolkit/utilities***
- ***Educational/Computer Aided Learning***

Owen Linderholm selects the best of readers' programs. For details on submitting your own, see the end of this section.

What we want

I'm glad to see an improvement in the standard of submissions to 'Program File'. This is partly due to the fact that some of the better regular contributors have stepped up their output, but some new names have been producing rather good programs. Especially encouraging is that some programs include adequate documentation and clear comments within the programs themselves — this makes my job of selection easier, and also means that I am likely to be favourably disposed towards such programs. After all, if a program has no accompanying documentation and then doesn't seem to do much when run, I'll assume that it isn't any good and return it.

The ideal program is interesting, performs a useful function, is clearly written, and is documented well enough for anyone to convert it to run on another machine. Unfortunately such jewels are rare, and I usually have to accept a compromise — a very good program with poor documentation, or a reasonable program with documentation good enough to make the program easy to improve.

I have been ignoring games programs for some months simply because the games which come in are not good enough: most are tacky rip-offs of standard arcade games. They are written in awful bastardisations of machine code and Basic, without any explanation of which bits do what, and to round it all off, they are all plagued by bugs. I realise that for some forms of action some machine code is necessary, but please use it in a separate routine and explain how it works and what it does.

Strategy games are submitted less often. They suffer from fewer problems but still aren't up to scratch. Generally they are faithful reproductions of various games, but they don't encourage the computer to play a good game. It would be nice to see strategy games use some of the methods expounded by David Levy in his old *APC* computer game column; this column was widely used and reprinted, and much of it is available in book form. Other authors have written books covering computer game-playing, and any good computer bookshop should be able to help you out with finding them. (Incidentally, please don't send in programs for things like noughts and crosses or hangman; write something more exciting and challenging like a *good* poker player.)

Another area in which contributors have been slipping is in supplying hints and tips. Despite the demise of 'TJ's Workshop', we are quite happy to accept a wide range of tips for publication, including hardware hints. These will be paid for at much the same rate as the listings in 'Program File', and any tips which improve computer usage are welcome.

This month's programs

Amstrad Pro-Menu provides a set of subroutines to implement sophisticated pop-up menus on the Amstrad. These can then be incorporated into user programs to give them a more professional look.

There is a program to produce graphics printout from a daisywheel printer. This sounds like (and probably is) a misuse of technology, but the technique is interesting and could be useful to people who have only a daisywheel printer and need to print the occasional graphics. The program is written in MBasic for an IBM or compatible, but should be easy to convert to any other machine.

There is one program for the Spectrum this month — a machine code utility to provide a patterned fill routine. The program includes examples of it in action, and it looks extremely impressive. The filling action is very robust and fills in any area correctly. The patterns used are reminiscent of the Apple Macintosh and MacPaint, and show that flashy high-technology isn't the only way to get good results.

For the BBC there's a cross-referencing program that produces a list of which variables are used where within a Basic program. The program works extremely well, and should prove an invaluable aid to any BBC programmer who is in the middle of a long project.

One machine that's proving to be a real survivor in the computer wars is the old 8-bit Atari. When Jack Tramiel took over at Atari and started slashing prices, sales of the 8-bit machines finally took off. This is especially amazing when you consider that the basic Atari 8-bit machine was introduced long before even the Commodore 64. NLQ Printing provides letter-quality printing from an ordinary dot-matrix printer; this is achieved by redefining character fonts and using several passes of the print head. The limitations on the printers with which the program will work are that they should be capable of moving the print head by half the width of a single dot on the matrix, and ideally the printer should be Epson-compatible. Naturally the printing is slower than for ordinary quality, but the results are remarkable. Sample output is included with the listing.

Mark Needham pops up yet again this month. You might be forgiven for thinking that he has some kind of hold on me from the way that his name appears so regularly in 'Program File'; in fact, he just has an incredible ability to write good programs very quickly. If anyone is looking for a model on which to base their programs for 'Program File', they should look at Mark's programming style. SIDEPRINT prints text files sideways on an Epson-compatible printer. It's written in Turbo Pascal for an IBM, but shouldn't be too hard to convert to other machines.

Ian Davies' article (in the March issue of *APC*) on 'evolutionary programming' attracted quite a deal of interest. This month I'm pleased to present an article/program from T Hartley encompassing a proposed variation to evolutionary programming as it appeared in the March issue.

Amstrad CPC Promenu

by Kevin Nixon

This program allows menus to be easily included in your own programs. Examples of how to create and use menus within programs are given.

Two lines could not be printed and must be added to the program:

```
50370 LOCATE 1,v:CALL &BD19:
   PRINT"[CONTROL—X]"+m$(v)+
   SPACE$((wi)−LEN(m$(v)))+"
   [CONTROL−X];
50750 IF mh$<>"" THEN WINDOW
   £w,ml−1,mr,mt−2,mb:LOCATE
   £w,1,1:PRINT £w"[CONTROL−X]
   [SPACE]"+mh$+"[SPACE]
   [CONTROL−X]";
```

In these lines, type the bits between square brackets as single characters.

To create windows, certain variables have to be set and then a particular subroutine called. An example is line 130. The variables are:

ml — left position of window
mt — top of window
am — height of window
wi — width of window
w — the window number (0–7)
mh$ — the title of the window

GOSUB 50420 is used to create a window with a normal frame, GOSUB 50620 for one with a pull-down menu frame. If a window is accidentally positioned off-screen, it will be moved back on at the nearest point.

To create a menu, the options have to be in data statements as in line 180. The data is held as follows:

DATA menuno,type,title,xpos,ypos,option,option,. . .,*

menuno — used in conjunction with off(menuno,optionno)
type — 1 for ordinary, 2 for pull-down menu
title — any string, can be blank
xpos — left position for menu, 0 to centre on x plane
ypos — top position for menu, 0 to centre on y plane
option — the option name; if left blank, a line of separators will appear in its place
* — marks the end of the list of options

The maximum number of options in a menu is 23, or 22 if a title is used. Options within a menu can be switched off at any time using the off function:

off(menuno,optionno)=1

The result is to display the option in light type and prevent it from being selected until it's set to 0, which switches it on again.

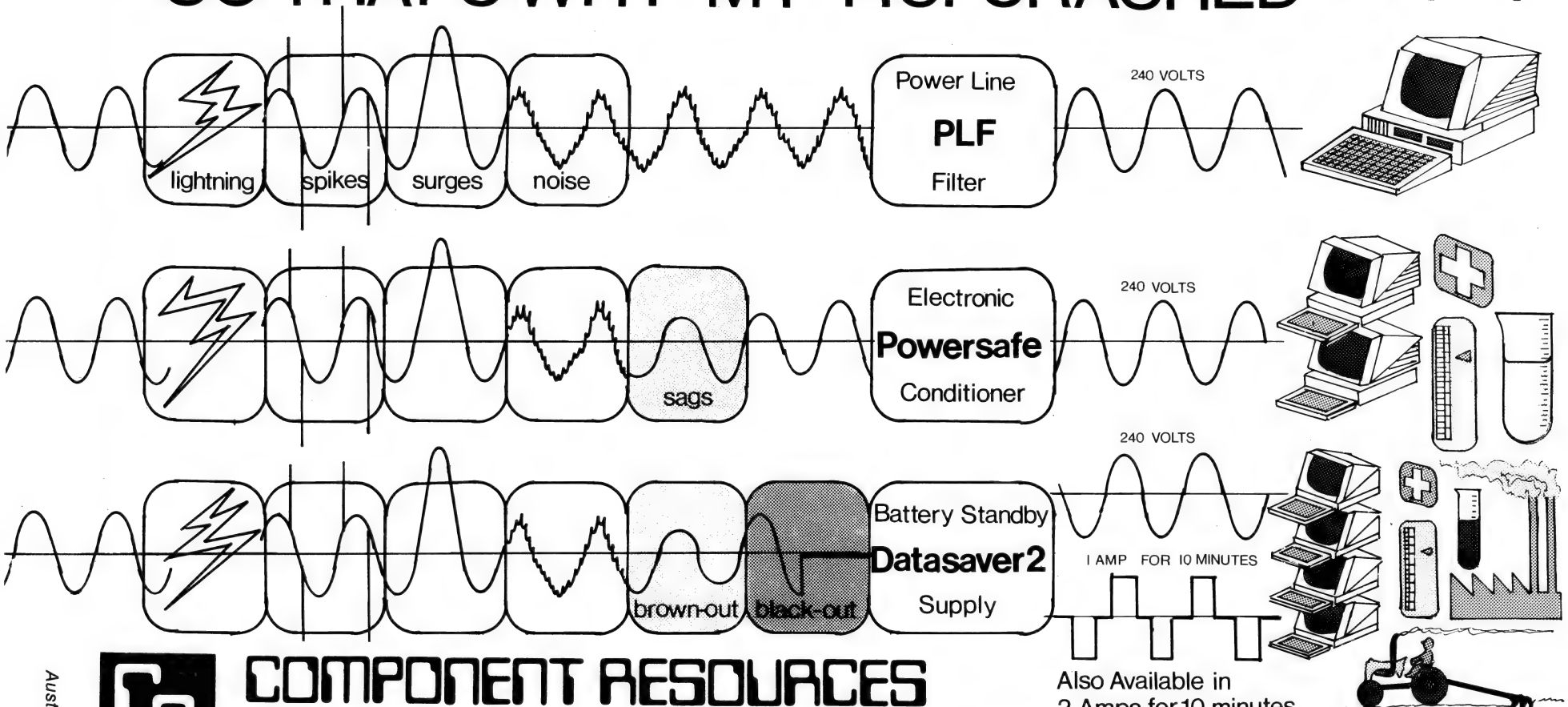
The program only works on the 464 and 664, but to convert it for the 6128, delete lines 70 and 51110 to 51200. Then replace the RSX calls in lines 50030 and 50260 with the equivalent on the 6128 using the bank manager RSXs supplied with the machine.

To use the menus, use the cursor and copy keys. To incorporate them into your own programs, lines 50200–50260 do the selecting and v holds the value of the position of the selection bar at the end, so this can be used to determine the course of action to be taken.

The variables holding the key codes for up, down and select are ku, kd and kf respectively.

```
10 MODE 2:RESTORE 51110:GOSUB 51110
20 INK 0,26:INK 1,0:BORDER 20
30 FOR a=1 TO 25:PRINT STRING$(80,207);:NEXT
40 DRAW 639,0,1:DRAW 639,398:DRAW 0,398:DRAW 0,0
50 DIM m$(24),off(25,24)
60 ku=0:kd=2:kf=9
70 RESTORE 51110:GOSUB 51110
80  REM ****************
90  REM * EXAMPLE DATA *
100 REM *  NO NEED TO  *
110 REM *  TO TYPE IN  *
120 REM ****************
130 ml=6:mt=10:am=10:wi=38:w=1:GOSUB 50420
140 LOCATE £1,16,3:PRINT £1,"PRO MENU":LOCATE £1,13,5:PRINT £1,"By Kevin Nixon":
LOCATE £1,4,9:PRINT £1,"For the Amstrad CPC464 computer."
150 off(1,2)=1:REM ** Option 2 ( complicted ) is unnavailable.
160 REM ** DATA FOR EXAMPLE MENU **
170 CALL &BB18:RESTORE 180
180 DATA 1,2,Example,0,0,Creating,complicated,menus,,is easy,with,Pro menu,*
190 GOSUB 50030:GOTO 170
50000 REM ***************
50010 REM ** PRO MENU **
50020 REM ***************
50030 |COPY:w=0:v=0:wi=0:n=0:opt=1
50040 READ menu,type,mh$,ml,mt:IF type<1 THEN type=1:ELSE IF type>2 THEN type=2
50050 WHILE m$(n)<>"*":n=n+1:READ m$(n):WEND:am=n-1
50060 IF am<1 THEN am=1
50070 GOSUB 51080
50080 FOR n=1 TO am:IF LEN(m$(n))>wi THEN wi=LEN(m$(n))
50090 NEXT
50100 IF LEN(mh$)>wi THEN wi=LEN(mh$)
50110 IF ml=0 THEN ml=41-INT(wi/2)
50120 IF mt=0 THEN mt=13-INT(am/2)
50130 ON type GOSUB 50420,50620
50140 GOSUB 50990:REM ** PRINT OPTIONS **
50150 GOSUB 50200
50160 WINDOW £w,1,80,1,25:RETURN
50170 REM ****************
50180 REM * UP 'N' DOWN *
50190 REM ****************
50200 GOSUB 50360
50210 WHILE INKEY(kf)=-1
50220 IF INKEY(ku)=0 AND v>1 THEN GOSUB 50300:GOSUB 50810:GOSUB 50360
50230 IF INKEY(kd)=0 AND v<am THEN GOSUB 50300:GOSUB 50900:GOSUB 50360
50240 WEND
50250 CALL &BFF9,&C9,&1CED,&CF00:REM ** CLEAR KEYBOARD BUFFER **
50260 |SHOW:RETURN
50270 REM *********************
50280 REM * DELETE HIGHLIGHT *
50290 REM *********************
50300 IF v<1 THEN v=1 ELSE IF v>am THEN v=am
50310 LOCATE 1,v:CALL &BD19:PRINT m$(v)+SPACE$((wi)-LEN(m$(v)));
50320 RETURN
50330 REM *********************
50340 REM * PRINT HIGHLIGHT *
50350 REM *********************
50360 IF v<1 THEN v=1 ELSE IF v>am THEN v=am
";
50380 SOUND 1,50,2:RETURN
50390 REM ******************
50400 REM * ORDINARY MENU *
50410 REM ******************
50420 IF mh$="" AND am>23 THEN am=23:ELSE IF am>22 THEN am=22
50430 IF wi>70 THEN wi=70
50440 IF ml<2 THEN ml=2:mr=ml+wi
50450 IF (mt<3 AND mh$<>"") THEN mt=3:mb=mt+am
50460 IF (mt<2 AND mh$="") THEN mt=2:mb=mt+am
50470 IF (mt=1 AND mh$="") THEN mt=2:mb=mt+am
50480 mr=ml+wi-1:mb=mt+am-1
50490 IF mr>79 THEN mr=79:ml=mr-wi
50500 IF mb>24 THEN mb=24:mt=mb-am+1
50510 gl=ml*8-12:gr=(mr*8)+3:gb=398-mb*16-2
50520 IF mh$<>"" THEN gt=398-mt*16+44:ELSE gt=398-mt*16+20
50530 ORIGIN 0,0,gl-4,gr+4,gt+4,gb-4:CLG
50540 MOVE gl,gt:DRAW gr,gt,1:DRAW gr,gb:DRAW gl,gb:DRAW gl,gt
50550 MOVE gl-4,gt+4:DRAW gr+4,gt+4:DRAW gr+4,gb-4:DRAW gl-4,gb-4:DRAW gl-4,gt+4
50560 IF mh$<>"" THEN TAG:MOVE gl+(gr-gl)/2-LEN(mh$)*8/2,gt-6:PRINT mh$;:TAGOFF:
MOVE gl,gt-24:DRAW gr,gt-24
50570 WINDOW £w,ml,mr,mt,mb
50580 RETURN
50590 REM ******************
50600 REM * PULL DOWN MENU *
50610 REM ******************
```

SO THAT'S WHY MY P.C. CRASHED ! ! ! !



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```
50620 IF mh$<>"" AND am>22 THEN am=22
50630 IF mh$="" AND am>23 THEN am=23
50640 IF ml<2 THEN ml=2:mr=ml+wi
50650 IF (mt<3 AND mh$<>"") THEN mt=3:mb=mt+am
50660 IF (mt<2 AND mh$="") THEN mt=2:mb=mt+am
50670 IF mh$<>"" AND LEN(mh$)>wi-1 THEN wi=wi+1
50680 mr=ml+wi-1:mb=mt+am-1
50690 IF mr>79 THEN mr=79:ml=mr-wi+1
50700 IF mb>24 THEN mb=24:mt=mb-am+1
50710 gl=ml*8-12:gr=(mr*8)+3:gb=398-mb*16-2
50720 IF mh$<>"" THEN gt=398-mt*16+28:ELSE gt=398-mt*16+20
50730 ORIGIN 0,0,gl-4,gr+4,gt+4,gb-4:CLG
50740 MOVE gl-4,gt+4:DRAW gr+4,gt+4:DRAW gr+4,gb-4:DRAW gl-4,gb-4:DRAW gl-4,gt+4
 "+mh$+"
";
50760 WINDOW £w,ml,mr,mt,mb
50770 RETURN
50780 REM ************************************
50790 REM * SEARCH UP FOR NEAREST LEGAL OPTION *
50800 REM ************************************
50810 opt=v
50820 opt=opt-1
50830 IF opt=0 THEN 50850
50840 IF m$(opt)="" OR off(menu,opt)=1 THEN GOTO 50820
50850 IF opt>0 THEN v=opt
50860 RETURN
50870 REM ************************************
50880 REM * SEARCH DOWN FOR NEAREST LEGAL OPTION *
50890 REM ************************************
50900 opt=v
50910 opt=opt+1
50920 IF opt>am THEN RETURN:REM 51120
50930 IF m$(opt)="" OR off(menu,opt)=1 THEN GOTO 50910
50940 IF opt<am+1 THEN v=opt
50950 RETURN
50960 REM *****************
50970 REM * PRINT OPTIONS *
50980 REM *****************
50990 FOR n=1 TO am
51000 LOCATE 1,n
51010 IF m$(n)="" THEN PRINT STRING$(wi,45);:GOTO 51040
51020 PRINT m$(n);
51030 IF off(menu,n)=1 THEN PRINT CHR$(22);CHR$(1):PEN 0:LOCATE 1,n:PRINT STRING
$(wi,207);:PEN 1:PRINT CHR$(22);CHR$(0);
51040 NEXT:RETURN
51050 REM *******************************
51060 REM * FIND START POSITION FOR BAR *
51070 REM *******************************
51080 v=v+1:IF v=am THEN RETURN
51090 IF m$(v)="" OR off(menu,v)=1 THEN GOTO 51080
51100 RETURN
51110 REM RSX's
51120 REM |TURBO,|COPY,|SHOW
51130 MEMORY &3999
51140 FOR f=40000 TO 40071:READ a$:POKE f,VAL("&"+a$):NEXT
51150 CALL 40000
51160 DATA 01,4a,9c,21,84,9c,cd,d1,bc,c9,55,9c,c3,63,9c,c3,6c,9c
51170 DATA c3,78,9c,54,55,52,42,cf,43,4f,50,d9,53,48,4f,d7,00,21
51180 DATA 5f,00,3e,05,cd,68,bc,c9,21,00,c0,11,00,40,01,00,40,ed
51190 DATA b0,c9,21,00,40,11,00,c0,01,00,40,ed,b0,c9,00,00,00,00
51200 RETURN
```

MBasic Daisywheel Graphics

by Christopher Lawton

This program simulates graphics printing on a daisywheel. It has been written to work with a Brother HR25, but can be rewritten to work with other daisywheels.

The program uses the full stop as a notional pixel, and uses microjustification to move the print head by sufficiently small amounts. The printer head can be moved in 1/60ths of an inch horizontally and 1/16ths of an inch vertically. As the program moves the print head, it scans the computer screen. If a pixel on the screen is on, then it prints a full stop; otherwise it prints nothing.

The program takes a long time, however, because to print one screen of graphics it needs to effectively print 128,000 characters.

The printing routine is in lines 90–380, and lines 1000 onward should hold a routine to display the graphics to be drawn on screen two. A BLOAD statement could be used to load a previously-created graphics screen.

The program needs to use line lengths of 640 characters because it's printing a full stop every sixtieth of an inch. This is done by typing BASICA/S:640 from DOS.

The printer control codes used are:
line 130 — CHR$(27)+CHR$(&H1E)+CHR$(4) — set VMI to 3/48in
line 140 — CHR$(27)+CHR$(&H1F)+CHR$(3) — set HMI to 2/120in
line 200 — CHR$(32) — print a space
line 240 — CHR$(&H2E) — print a full stop
line 260 — CHR$(27)+CHR$(&H55) — advance paper by VMI
line 310 — CHR$(27)+CHR$(34) — reset auto line feed
line 320 — CHR$(27)+CHR$(83) — reset HMI and VMI

These codes can be used to run the program with other printers.

```
10 CLS:KEY OFF
20 SCREEN 2
30 GOSUB 390:                                   '   JUMP TO DRAW PICTURE.
40 '
50 '
60 '             BEGIN PRINT ROUTINE
70 '
80 '
90 OPEN "LPT1:" AS #1 LEN=640                   '   OPEN FILE TO PRINTER WITH
100 WIDTH#1,255 '                                   LINE LENGTH OF 640 CHARACTERS
110 '
120 '
130 PRINT#1,CHR$(27)+CHR$(&H1E)+CHR$(3)         '   SET VERTICAL SPACING
140 PRINT#1,CHR$(27)+CHR$(&H1F)+CHR$(2)         '   SET HORIZONTAL SPACING
150 '
160 '
170 '
180 FOR T=0 TO 199                              '   BEGIN VERTICAL SCANNING
190 FOR TT=0 TO 639                             '   BEGIN HORIZONTAL SCANNING
200           IF POINT (TT,T) = 0 THEN
                      PRINT#1,CHR$(32);
                      :GOTO 250                 '   PRINT SPACE IF PIXEL IS OFF
210 '
220 '
230 '
240           PRINT#1,CHR$(&H2E);               '   OTHERWISE PRINT FULL STOP
250       NEXT TT
260       PRINT#1,CHR$(27)+CHR$(&H55)           '   MOVE ROLLER UP ONE LINE
270 NEXT T
280 '
290 '
300 '
310 PRINT#1,CHR$(27)+CHR$(34)                   '  RESET PRINTER TO INITIAL
320 PRINT#1,CHR$(27)+CHR$(83)                   '        SETTINGS
330 '
340 '
350 CLOSE#1                                     '  CLOSE PRINTER FILE
360 '
370 '
380 END
390 '
400 '
410 '             ****    D R A W    P I C T U R E    ****
420 '
430 '
440 PRINT
450 LOCATE 25,1:PRINT "   Daisywheel
      Graphics"
460 PI=3.14159:SC=5/12                                  ASSIGN PI & SET SCREEN RATIO
470 X=250 :Y=0:CX=320:CY=100:SF=.95
480 C=COS(PI/5):S=SIN(PI/5)
490 C1=COS(PI/36):S1=SIN(PI/36)
500 FOR J=1 TO 40
```

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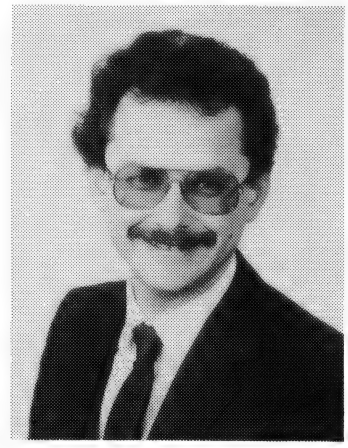

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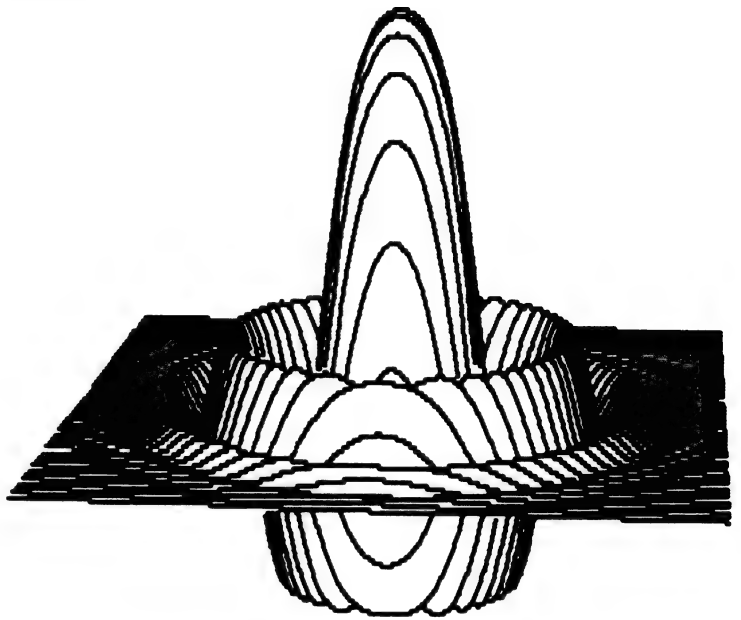
```
510 FOR I=0 TO 10
520 SX=X+CX:SY=CY-Y*SC
530 IF I=0 THEN PSET (SX,SY)
540 LINE - (SX,SY)
550 XN=X*C-Y*S:Y=X*S+Y*C:X=XN
560 NEXT I
570 XN=SF*(X*C1-Y*S1):Y=SF*(X*S1+Y*C1):X=XN
580 NEXT J
590 RETURN
```



Spectrum Textured Screen Print

by Nathan Walker

This program demonstrates the accompanying machine code routine which performs an area fill using patterns. The routine is stored in memory from location 50000 onwards and will fill any shape with any one of the 21 graphics characters. By altering these, it is possible to fill any shape with any character of 8 by 8 pixels. To use the routine in your own programs, type the program in and run it. When 'press any key to continue' is displayed, break into the program. Save the machine code as: SAVE "fill" CODE 50000,250. This file can then be used by loading it into memory and calling

PLOT xposition , yposition
RANDOMIZE character
LET fill=USR 50000

where xposition and yposition are coordinates of a point within the shape to be filled, character is the number of the character to be used, and fill is any dummy variable.

Line 4020 should have a # character before the zero.

```
  10 REM Textured Screen Print for ZX Spectrum 48K
  20 REM Nathan Walker
  30 REM 16.4.86 - 19.4.86
  40 REM
  50 CLEAR 49999
  60 BORDER 7: PAPER 7
  70 INK 0
  80 BRIGHT 1: FLASH 0
  90 CLS
  98 REM
  99 REM
 100 REM Read machine code
 110 REM
 120 RESTORE 9000
 130 FOR i=50000 TO 50249
 140    READ byte
 150    POKE i,byte
 160    NEXT i
 198 REM
 199 REM
 200 REM Read graphic characters
 210 REM
 220 RESTORE 8000
 230 FOR i=USR "a" TO USR "u"+7
 240    READ udg
 250    POKE i,udg
 260    NEXT i
1000 REM Demonstration 1   Bars
1010 REM
1020 FOR i=1 TO 21
1030    PLOT i*12,0
1040    DRAW 0,175
1050    PLOT i*12-1,88
1060    RANDOMIZE i
1070    LET fill=USR 50000
1080    NEXT i
1090 GO SUB 4000
1498 REM
1499 REM
1500 REM Demonstration 2   Circles
1510 REM
1520 FOR i=1 TO 21
1530    CIRCLE 20+i*10,20+160*(i/4-INT (i/4)),19
1540    PLOT 20+i*10,20+160*(i/4-INT (i/4))
1550    RANDOMIZE i
1560    LET fill=USR 50000
1570    NEXT i
1580 GO SUB 4000
1998 REM
1999 REM
2000 REM Demonstration 3   Spiral
2010 REM
2020 PLOT 128,88
2030 FOR i=2 TO 162 STEP 8
2040    DRAW 0,i
2050    DRAW i,0
2060    DRAW 0,-(i+4)
2070    DRAW -(i+4),0
2080    NEXT i
2090 DRAW 4,4
2100 PLOT 129,88
2110 RANDOMIZE 1
2120 LET fill=USR 50000
2130 GO SUB 4000
2998 REM
2999 REM
3000 REM Demonstration 4   Random lines
3010 REM
3020 RANDOMIZE
3030 FOR i=1 TO 20
3040    LET x1=INT (RND*256)
3050    LET x2=INT (RND*256)
3060    LET y1=INT (RND*176)
3070    LET y2=INT (RND*176)
3080    PLOT x1,y1
3090    DRAW (x2-x1),(y2-y1)
3100    NEXT i
3110 PLOT 0,0
3120 RANDOMIZE 1+INT (RND*21)
3130 LET fill=USR 50000
3140 GO SUB 4000
3150 GO TO 3000
4000 REM
```

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```
4010 REM
4020 PRINT  0;"   Press any key to continue"
4030 PAUSE 0
4040 CLS
4050 RETURN
7998 REM
7999 REM
8000 REM Data for the graphic characters
8010 REM
8020 DATA 85,170,85,170,85,170,85,170,204,204,51,51,204,204,51,51
8030 DATA 136,68,34,17,136,68,34,17,238,119,119,238,238,119,119,238
8040 DATA 254,130,254,0,239,40,239,0,254,254,254,0,239,239,239,0
8050 DATA 238,245,251,245,238,95,191,95,170,119,221,119,170,221,119,221
8060 DATA 204,187,119,119,51,238,221,221,0,85,0,170,0,85,0,170
8070 DATA 170,109,198,19,200,99,182,85,136,136,136,255,136,136,136,255
8080 DATA 170,255,170,255,170,255,170,255,124,216,141,199,227,177,27,62
8090 DATA 17,34,68,136,17,34,68,136,160,64,160,17,10,4,10,17
8100 DATA 170,170,170,170,170,170,170,170,255,0,255,0,255,0,255,0
8110 DATA 136,136,136,136,136,136,136,136,255,0,0,0,255,0,0,0
8120 DATA 128,64,32,16,8,4,2,1
8998 REM
8999 REM
9000 REM Data for the machine code
9010 REM
9020 DATA 237,75,125,92,205,170,34,71,4,62,254,15,16,253,166,119,33,0,64,17,139,
202,1,0,24
9030 DATA 237,176,33,75,196,237,75,125,92,113,35,112,33,1,0,34,71,196,33,0,0,34,
73,196,33
9040 DATA 75,196,17,107,199,78,35,70,35,229,121,254,255,40,6,197,12,205,221,195,
193,121,254,0,40
9050 DATA 6,197,13,205,221,195,193,120,254,0,40,6,197,5,205,221,195,193,4,120,25
4,176,196,221,195
9060 DATA 42,71,196,43,34,71,196,124,181,225,32,199,42,73,196,124,181,40,62,77,6
8,203,33,203,16
9070 DATA 33,107,199,17,75,196,237,176,42,73,196,34,71,196,24,158,197,205,170,34
,71,4,126,7,16
9080 DATA 253,230,1,193,192,235,113,35,112,35,235,42,73,196,35,34,73,196,205,170
,34,71,4,62,1
9090 DATA 15,16,253,182,119,201,42,123,92,17,0,64,237,75,117,92,175,5,203,32,203
,32,203,32,176
9100 DATA 40,3,35,16,253,14,3,6,8,229,197,6,0,26,166,18,19,16,250,35,193,16,243,
225,13,32
9110 DATA 236,33,0,64,17,139,202,1,0,24,26,182,119,19,35,11,120,177,32,246,201,0
,0,1,0
```

Atari NLQ Printing

by Matthew Dunn

This program produces near-letter quality output with any Epson-compatible printer. It has been written in standard Atari Basic and should be easy to convert to other machines. It has been used successfully with several printers and computers.

The program should work with any printer capable of producing high-resolution graphics, since the main requirement is that the printer should be able to move the paper by about half the spacing of the print heads. The program will not, however, work correctly with a 7-bit printer interface.

Each character the program prints has been redefined in a matrix 16 dots high by 18 dots wide. This is done in the data statements at the end of the program, and it should be possible to alter these to produce alternative typefaces. The program takes in one line of text at a time from the input file. Each line is scanned and 32 taken from each character, so the code for a space becomes 0 and for a lower-case z, 90. This number is used to locate the appropriate number in the data array, which is stored as a string in the Atari because integers and two-dimensional string arrays are not possible in Atari Basic. The string array also allocates one byte per character and so uses less memory. A two-dimensional array is simulated by multiplying each character by 36 to find its starting position in the string.

In the first printing pass, the first 18 bytes of data are sent to the printer, unless it's a character that has a descender. If a descender is used, spaces are printed at this point. The line is then reprinted and the second 18 bytes for each character are sent to the printer. The third pass prints the first 18 bytes for characters with descenders, and the fourth the last 18. The four passes are necessary to maintain resolution and produce true descenders. An example of printout is given at the end of the listing.

```
1000 Rem ############################
1010 Rem #                          #
1020 Rem #    NLQ PRINTING FOR      #
1030 Rem # EPSON, GEMINI AND EPSON #
1040 Rem #   COMPATIBLE PRINTERS    #
1050 Rem # COPYRIGHT  M.DUNN  1986 #
1060 Rem #                          #
1070 Rem ############################
1080 Rem
1090 Gosub 2380:Rem INITIALISE DATA ARRAY
1100 Graphics 0:Print "Filespec of list file:";
1110 Trap 1100:Input File$
1120 Close #1:Open #1,4,0,File$
1130 Print "Press RETURN when printer ready";
1140 Trap 1160:Input Line$:Rem Wait for RETURN to be pressed
1150 Close #7:Open #7,8,0,"P:":Goto 1170
1160 Print "PRINTER FAILED TO OPEN";Chr$(253):Goto 1130
1170 Rem
1180 Rem ########################
1190 Rem #      MAIN LOOP       #
1200 Rem # GETS ONE LINE OF TEXT #
1210 Rem # FROM THE TEXT FILE &  #
1220 Rem # PASSES IT TO THE NLQ  #
1230 Rem # ROUTINE IN LINE$.     #
1240 Rem ########################
1250 Rem
1260 Trap 1100:Rem Start again at end of file
1270 Input #1,Line$:Rem Get a line of text from file
1280 Gosub 1400:Rem CONVERT & PRINT ONE LINE
1290 Goto 1270
1300 Rem
1310 Rem ############################
1320 Rem # NLQ CONVERSION ROUTINE  #
1330 Rem # SOURCE LINE IN LINE$    #
1340 Rem # NLQ SOURCE DATA IN DAT$ #
1350 Rem # NLQ OUTPUT DATA IN NLQ$ #
1360 Rem ############################
1370 Rem ---------------------------------
1380 Rem PHASE 1 :Upper Half of Characters
1390 Rem ---------------------------------
1400 Linepoint=1:Nlq$=""
1410 For Chpoint=1 To Len(Line$)
1420   A=Asc(Line$(Chpoint,Chpoint))-32:Rem get and convert presant character
1430   If A<0 Or A>90 Then A=0:Rem UNDEFINED CODES
1440   Rem IGNORE CHARACTERS WITH DESCENDERS
1450   If A=12 Or A=27 Or A=71 Or A=74 Or A=80 Or A=81 Or A=89 Then A=0
1460   For I=1 To 18
1470     Nlq$(Linepoint,Linepoint)=Dat$(A*36+I):Linepoint=Linepoint+1
1480   Next I
1490   For I=1 To 4:Rem INTER CHARACTER SPACES
1500     Nlq$(Linepoint,Linepoint)=Chr$(0):Linepoint=Linepoint+1
1510   Next I
1520 Next Chpoint
1530 Linepoint=Linepoint-1
1540 Rem Set linefeed to 1/144 inch
1550 Print #7;Chr$(27);Chr$(51);Chr$(1);
1560 A=Int(Linepoint/256):B=Linepoint-256*A
1570 Rem Print NLQ$ at 240 dots per inch
1580 Print #7;Chr$(27);Chr$(Hires);Chr$(B);Chr$(A);Nlq$
1590 Rem ---------------------------------
1600 Rem PHASE 2 :Lower Half of Characters
1610 Rem ---------------------------------
```

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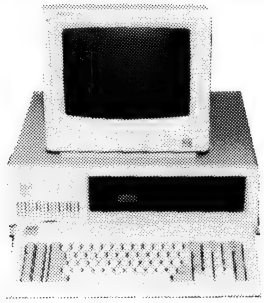

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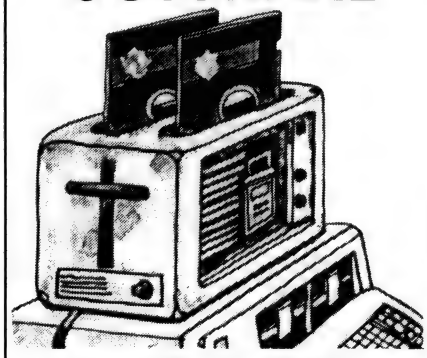

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```
1620 Linepoint=1:Nlq$=""
1630 For Chpoint=1 To Len(Line$)
1640   A=Asc(Line$(Chpoint,Chpoint))-32
1650   If A<0 Or A>90 Then A=0
1660   If A=12 Or A=27 Or A=71 Or A=74 Or A=80 Or A=81 Or A=89 Then A=0
1670   For I=19 To 36
1680     Nlq$(Linepoint,Linepoint)=Dat$(A*36+I):Linepoint=Linepoint+1
1690   Next I
1700   For I=1 To 4
1710     Nlq$(Linepoint,Linepoint)=Chr$(0):Linepoint=Linepoint+1
1720   Next I
1730 Next Chpoint
1740 Linepoint=Linepoint-1
1750 Print #7;Chr$(27);Chr$(51);Chr$(5);
1760 A=Int(Linepoint/256):B=Linepoint-256*A
1770 Print #7;Chr$(27);Chr$(Hires);Chr$(B);Chr$(A);Nlq$
1780 Rem ---------------------------------
1790 Rem PHASE 3 :Upper Half of descenders
1800 Rem ---------------------------------
1810 Linepoint=1:Nlq$="":Underline=0
1820 For Chpoint=1 To Len(Line$)
1830   A=Asc(Line$(Chpoint,Chpoint))-32
1840   If A=-5 Then Gosub 2270:Rem ESCAPE CHARACTER
1850   If A=12 Or A=27 Or A=71 Or A=74 Or A=80 Or A=81 Or A=89 Then 1870
1860   A=0
1870   For I=1 To 18
1880     Nlq$(Linepoint,Linepoint)=Chr$(Asc(Dat$(A*36+I))+Underline)
1890     Linepoint=Linepoint+1
1900   Next I
1910   For I=1 To 4
1920     Nlq$(Linepoint,Linepoint)=Chr$(Underline):Linepoint=Linepoint+1
1930   Next I
1940 Next Chpoint
1950 Linepoint=Linepoint-1
1960 Print #7;Chr$(27);Chr$(51);Chr$(1);
1970 A=Int(Linepoint/256):B=Linepoint-256*A
1980 Print #7;Chr$(27);Chr$(Hires);Chr$(B);Chr$(A);Nlq$
1990 Rem ---------------------------------
2000 Rem PHASE 4 :Lower Half of descenders
2010 Rem ---------------------------------
2020 Linepoint=1:Nlq$=""
2030 For Chpoint=1 To Len(Line$)
2040   A=Asc(Line$(Chpoint,Chpoint))-32
2050   If A=12 Or A=27 Or A=71 Or A=74 Or A=80 Or A=81 Or A=89 Then 2070
2060   A=0
2070   For I=19 To 36
2080     Nlq$(Linepoint,Linepoint)=Dat$(A*36+I):Linepoint=Linepoint+1
2090   Next I
2100   For I=1 To 4
2110     Nlq$(Linepoint,Linepoint)=Chr$(0):Linepoint=Linepoint+1
2120   Next I
2130 Next Chpoint
2140 Linepoint=Linepoint-1
2150 Print #7;Chr$(27);Chr$(65);Chr$(11);
2160 A=Int(Linepoint/256):B=Linepoint-256*A
2170 Print #7;Chr$(27);Chr$(Hires);Chr$(B);Chr$(A);Nlq$
2180 Return
2190 Rem
2200 Rem ############################
2210 Rem # ROUTINE TO CHECK FOR     #
2220 Rem # EPSON UNDERLINE CODES    #
2230 Rem # UNDERLINE   ON=27,45,1   #
2240 Rem # UNDERLINE  OFF=27,45,0   #
2250 Rem ############################
2260 Rem
2270 If Len(Line$)<Chpoint+2 Then 2560
2280 If Line$(Chpoint+1,Chpoint+1)<>"-" Then 2560
2290 If Line$(Chpoint+2,Chpoint+2)=Chr$(1) Then Underline=2:Goto 2550
2300 Underline=0
2310 Chpoint=Chpoint+2
2320 Return
2330 Rem
2340 Rem ############################
2350 Rem # Initialise data table    #
2360 Rem ############################
2370 Rem
2380 Dim Dat$(91*36),File$(16),Nlq$(1920),Line$(87)
2390 Graphics 2:Print #6:Print #6;" nlq printer driver":Print #6
2400 Print #6;"  BY M.DUNN 1986":Print #6
2410 Print #6;" initialising array"
2420 Rem Load NLQ character set into DAT$
2430 Restore 2600
2440 For I=0 To 90:Checksum=0
2450   For J=1 To 36
2460     Read A:Dat$(I*36+J)=Chr$(A):Checksum=Checksum+A
2470   Next J
2480   Position 9,7:Print #6;90-I;" "
2490   Read A:If A<>Checksum Then Print "Error in data:Character";I+32
2500 Next I
2510 Rem Delete or alter following lines as appropriate
2520 Rem For wide characters use L instead of Z
2530 Hires=Asc("Z"):Rem For Epson Printers
2540 Hires=Asc("z"):Rem For Gemini Printers
2550 Return
2560 Rem
2570 Rem ############################
2580 Rem # Start of NLQ character set #
2590 Rem ############################
2600 Rem
2610 Rem Character 32=SPACE
2620 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2630 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2640 Rem Character 33=!
2650 Data 0,0,0,0,0,0,0,0,56,61,56,0,0,0,0,0,0,0
2660 Data 0,0,0,0,0,0,0,0,48,124,48,0,0,0,0,0,0,0,0,393
2670 Rem Character 34="
2680 Data 0,0,0,0,0,96,112,96,0,0,0,0,0,96,112,96,0,0,0,0
2690 Data 0,0,0,16,80,64,96,0,0,0,16,80,64,96,0,0,0,0,0,1120
2700 Rem Character 35=#
2710 Data 0,3,0,8,8,11,62,8,9,73,64,64,64,64,0,0,33,1
2720 Data 2,0,5,5,5,0,62,66,64,0,1,1,1,1,65,65,32,0,847
2730 Rem Character 36=$
2740 Data 16,8,33,33,33,33,127,33,33,33,33,127,33,33,33,33,4,2
2750 Data 18,34,8,8,8,8,127,8,8,8,8,127,8,8,8,8,34,36,1152
2760 Rem Character 37=%
2770 Data 32,81,80,82,80,84,32,8,8,3,0,16,0,32,0,67,0,0
2780 Data 97,0,2,0,4,0,104,0,0,18,21,5,37,5,69,2,0,0,969
2790 Rem Character 38=&
2800 Data 2,36,17,65,72,72,72,72,72,64,69,21,16,34,0,5,0,0
2810 Data 4,34,72,24,1,1,1,1,9,25,16,64,70,32,6,0,9,9,1067
2820 Rem Character 39='
2830 Data 0,0,0,0,0,0,0,96,112,96,0,0,0,0,0,0,0,0
2840 Data 0,0,0,0,0,0,16,80,64,96,0,0,0,0,0,0,0,560
2850 Rem Character 40=(
2860 Data 0,0,0,12,18,32,1,64,0,0,0,0,0,0,0,0,0,0
2870 Data 0,0,0,24,36,2,64,1,0,0,0,0,0,0,0,0,0,254
2880 Rem Character 41=)
2890 Data 0,0,0,0,0,0,0,0,0,64,1,32,18,12,0,0,0,0
2900 Data 0,0,0,0,0,0,0,0,0,1,64,2,36,24,0,0,0,0,254
2910 Rem Character 42=*
2920 Data 0,0,0,0,18,0,12,0,12,0,18,0,0,0,0,0,0,0
2930 Data 0,8,8,42,8,28,8,8,8,28,8,42,8,8,0,0,0,0,272
2940 Rem Character 43=+
2950 Data 0,0,0,0,0,0,0,0,0,30,0,0,0,0,0,0,0,0,0
2960 Data 0,0,0,8,8,8,8,8,62,8,8,8,8,8,0,0,0,0,172
2970 Rem Character 44=,
2980 Data 0,0,0,0,0,0,0,0,12,14,12,0,0,0,0,0,0,0,0
2990 Data 0,0,0,0,0,0,2,10,8,12,0,0,0,0,0,0,0,0,70
3000 Rem Character 45=-
3010 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
3020 Data 0,0,0,8,8,8,8,8,8,8,8,8,8,8,0,0,0,0,88
3030 Rem Character 46=.
3040 Data 0,0,0,0,0,0,0,0,1,1,1,0,0,0,0,0,0,0,0
3050 Data 0,0,0,0,0,0,0,0,3,3,3,0,0,0,0,0,0,0,0,12
3060 Rem Character 47=/
3070 Data 0,0,1,0,2,0,4,0,8,0,16,0,32,0,64,64,0,0
3080 Data 1,1,0,2,0,4,0,8,0,16,0,32,0,64,0,0,0,0,319
3090 Rem Character 48=0
3100 Data 28,34,3,64,64,68,64,64,72,72,64,80,80,1,34,28,0,0
3110 Data 28,34,64,5,5,1,9,9,1,1,17,1,1,96,34,28,0,0,1154
3120 Rem Character 49=1
3130 Data 0,0,0,0,16,0,32,0,127,0,0,0,0,0,0,0,0,0
3140 Data 0,0,0,1,1,33,1,65,127,1,1,1,1,1,0,0,0,0,408
3150 Rem Character 50=2
3160 Data 0,16,33,0,2,66,64,64,68,68,68,64,64,72,72,0,48,1
3170 Data 1,33,1,67,65,1,5,5,1,1,1,9,9,1,1,81,33,1,1086
3180 Rem Character 51=3
3190 Data 0,66,64,65,65,64,64,64,80,80,64,64,96,105,73,64,70,64
3200 Data 0,0,2,0,0,1,17,17,17,17,49,49,17,0,64,74,4,0,1540
3210 Rem Character 52=4
```

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```
3220 Data 0,0,4,0,8,0,16,0,32,0,64,127,0,0,0,0,0,0
3230 Data 0,4,4,12,4,20,4,36,5,69,5,127,5,5,5,4,0,0,560
3240 Rem Character 53=5
3250 Data 0,122,73,73,72,72,72,72,72,72,72,72,72,73,73,64,70,0
3260 Data 0,114,0,0,1,1,1,1,1,1,1,1,0,0,10,68,0,1397
3270 Rem Character 54=6
3280 Data 6,1,8,0,16,0,32,0,0,64,64,0,0,0,5,2,0,0
3290 Data 6,8,9,25,9,41,9,73,73,9,9,9,9,9,0,6,0,0,502
3300 Rem Character 55=7
3310 Data 0,0,96,64,64,64,64,64,67,68,64,72,72,64,64,80,96,0
3320 Data 0,0,64,0,0,0,0,0,7,0,8,0,0,16,16,32,64,0,1270
3330 Rem Character 56=8
3340 Data 50,5,0,72,72,72,72,72,72,72,72,72,72,0,5,50,0,0
3350 Data 38,80,89,1,1,1,1,1,1,1,1,1,89,80,38,0,0,1254
3360 Rem Character 57=9
3370 Data 48,0,72,72,72,72,72,73,73,72,74,72,76,72,8,48,0,0
3380 Data 32,80,0,0,0,1,1,0,0,2,0,4,0,8,64,48,0,0,1216
3390 Rem Character 58=:
3400 Data 0,0,0,0,0,0,0,18,18,18,0,0,0,0,0,0,0,0
3410 Data 0,0,0,0,0,0,0,54,54,54,0,0,0,0,0,0,0,0,216
3420 Rem Character 59=;
3430 Data 0,0,0,0,0,0,0,44,46,44,0,0,0,0,0,0,0,0
3440 Data 0,0,0,0,0,0,2,106,104,108,0,0,0,0,0,0,0,0,454
3450 Rem Character 60=<
3460 Data 0,0,0,0,12,12,0,0,18,18,0,0,33,33,0,0,0,0
3470 Data 0,0,8,8,0,0,20,20,0,0,34,34,0,0,65,65,0,0,380
3480 Rem Character 61==
3490 Data 0,0,2,2,2,2,2,2,2,2,2,2,2,2,2,0,0
3500 Data 0,0,16,16,16,16,16,16,16,16,16,16,16,16,16,0,0,252
3510 Rem Character 62=>
3520 Data 0,0,0,0,33,33,0,0,18,18,0,0,12,12,0,0,0,0
3530 Data 0,0,65,65,0,0,34,34,0,0,20,20,0,0,8,8,0,0,380
3540 Rem Character 63=?
3550 Data 0,0,32,0,0,64,64,64,70,68,64,64,72,8,0,48,0,0
3560 Data 0,0,32,64,64,0,0,0,5,0,8,8,0,64,80,32,0,0,975
3570 Rem Character 64=@
3580 Data 30,32,1,64,76,64,82,82,82,82,82,64,76,66,82,0,36,24
3590 Data 60,2,64,1,9,21,1,1,1,1,1,21,13,17,1,69,0,56,1364
3600 Rem Character 65=A
3610 Data 0,0,1,2,4,8,16,32,64,64,32,16,8,4,2,1,0,0
3620 Data 1,1,3,5,13,20,36,68,4,4,68,36,20,13,5,3,1,1,556
3630 Rem Character 66=B
3640 Data 64,64,64,127,72,72,72,72,72,72,72,72,72,72,1,52,2,0
3650 Data 1,1,1,127,1,1,1,1,1,1,1,1,1,1,88,34,4,0,1360
3660 Rem Character 67=C
3670 Data 8,20,2,32,1,1,64,64,64,64,64,64,64,64,1,32,34,0
3680 Data 8,20,32,2,64,64,1,1,1,1,1,1,1,1,64,2,34,0,941
3690 Rem Character 68=D
3700 Data 64,64,64,127,64,64,64,64,64,64,64,1,1,32,2,20,8,0,0
3710 Data 1,1,1,127,1,1,1,1,1,1,64,64,2,32,20,8,0,0,1093
3720 Rem Character 69=E
3730 Data 64,64,127,72,72,72,72,72,72,72,72,72,64,64,64,64,64,64
3740 Data 1,1,127,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1431
3750 Rem Character 70=F
3760 Data 64,64,127,72,72,72,72,72,72,72,72,72,64,64,64,64,64,64
3770 Data 1,1,127,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,1418
3780 Rem Character 71=G
3790 Data 8,20,2,32,1,1,64,64,64,64,64,64,68,69,5,6,36,4,4
3800 Data 8,20,32,2,64,64,1,1,1,1,1,1,0,64,70,32,0,0,938
3810 Rem Character 72=H
3820 Data 0,64,64,127,72,72,8,8,8,8,8,8,72,72,127,64,64,0
3830 Data 0,1,1,127,1,1,0,0,0,0,0,0,1,1,127,1,1,0,1108
3840 Rem Character 73=I
3850 Data 0,0,0,0,0,64,64,64,127,64,64,64,0,0,0,0,0,0
3860 Data 0,0,0,0,0,1,1,1,127,1,1,1,0,0,0,0,0,0,644
3870 Rem Character 74=J
3880 Data 0,6,0,1,1,0,0,0,0,0,65,65,66,124,64,64,64,0
3890 Data 0,4,2,0,0,1,1,1,1,1,1,0,0,2,124,0,0,0,0,657
3900 Rem Character 75=K
3910 Data 64,64,127,64,64,8,12,4,0,16,18,2,64,96,97,65,64,64
3920 Data 1,1,127,9,9,8,0,16,20,4,0,32,35,3,65,65,1,1,1290
3930 Rem Character 76=L
3940 Data 0,64,64,127,64,64,0,0,0,0,0,0,0,0,0,1,0,0
3950 Data 1,1,1,127,1,1,1,1,1,1,1,1,1,1,3,0,0,528
3960 Rem Character 77=M
3970 Data 64,64,127,0,32,0,16,0,8,8,0,16,0,32,0,127,64,64
3980 Data 1,1,127,65,1,32,0,16,0,0,16,0,32,1,65,127,1,1,1108
3990 Rem Character 78=N
4000 Data 64,64,127,0,32,0,16,0,8,0,4,0,66,64,65,127,64,64
4010 Data 1,1,127,65,1,32,0,16,0,8,0,4,0,2,0,127,1,1,1151
4020 Rem Character 79=O
4030 Data 8,20,2,32,1,1,64,64,64,64,64,64,64,1,1,32,2,20,8
4040 Data 8,20,32,2,64,64,1,1,1,1,1,1,1,64,64,2,32,20,8,898
4050 Rem Character 80=P
4060 Data 64,64,64,127,64,64,64,64,64,64,64,64,64,64,64,8,8,32,16
4070 Data 1,1,1,127,9,9,9,8,8,8,8,8,8,8,64,64,16,32,1412
4080 Rem Character 81=Q
4090 Data 8,20,2,32,1,1,64,64,64,64,64,68,1,3,32,3,21,8,0
4100 Data 8,20,32,2,64,64,1,1,1,9,1,68,64,2,32,20,9,1,855
4110 Rem Character 82=R
4120 Data 64,64,64,127,64,64,64,64,64,64,64,68,64,66,64,9,8,32,16
4130 Data 1,1,1,127,9,9,9,8,8,8,8,12,9,11,65,65,17,33,1431
4140 Rem Character 83=S
4150 Data 3,48,1,1,72,72,72,72,72,72,72,72,72,1,1,36,98
4160 Data 39,2,80,80,1,1,1,1,1,1,1,1,1,1,72,72,2,100,1366
4170 Rem Character 84=T
4180 Data 96,64,64,64,64,64,64,64,64,127,64,64,64,64,64,64,64,96,0
4190 Data 96,0,0,0,0,1,1,1,127,1,1,1,0,0,0,0,96,0,1540
4200 Rem Character 85=U
4210 Data 64,64,126,64,65,64,0,0,0,0,0,0,64,65,64,126,64,64
4220 Data 0,0,124,2,0,1,1,1,1,1,1,1,1,0,2,124,0,0,1154
4230 Rem Character 86=V
4240 Data 64,64,96,80,72,68,2,1,0,0,1,2,68,72,80,96,64,64
4250 Data 0,0,64,32,16,8,4,2,1,1,2,4,8,16,32,64,0,0,1148
4260 Rem Character 87=W
4270 Data 64,64,124,66,65,0,0,1,2,12,2,1,0,64,65,126,64,64
4280 Data 0,0,120,6,0,1,1,0,6,24,4,2,1,1,0,126,0,0,1076
4290 Rem Character 88=X
4300 Data 64,64,64,65,96,66,80,4,8,8,4,80,66,96,65,64,64,64
4310 Data 1,1,1,65,3,33,5,16,8,8,16,5,33,3,65,1,1,1,1288
4320 Rem Character 89=Y
4330 Data 64,64,64,96,64,80,0,8,7,8,0,16,64,96,64,64,64,64
4340 Data 0,0,64,0,32,1,17,1,15,1,17,1,32,0,64,0,0,0,1132
4350 Rem Character 90=Z
4360 Data 0,0,96,65,64,66,64,68,64,72,64,80,64,96,64,65,0,0
4370 Data 0,0,65,1,3,1,5,1,9,1,17,1,33,1,65,3,0,0,1198
4380 Rem Character 91=[
4390 Data 0,0,0,0,127,64,64,64,64,64,64,64,0,0,0,0,0,0
4400 Data 0,0,0,0,127,1,1,1,1,1,1,0,0,0,0,0,0,644
4410 Rem Character 92=\
4420 Data 8,20,32,2,1,64,64,64,64,64,64,64,64,1,2,32,20,8
4430 Data 24,33,5,65,67,1,1,0,0,0,0,1,1,67,65,5,33,24,1030
4440 Rem Character 93=]
4450 Data 0,0,0,0,0,64,64,64,64,64,64,127,0,0,0,0,0,0
4460 Data 0,0,0,0,0,1,1,1,1,1,1,127,0,0,0,0,0,0,644
4470 Rem Character 94=^
4480 Data 1,0,2,4,8,16,36,4,4,4,0,8,0,24,36,0,0,0
4490 Data 0,2,4,8,16,40,64,0,0,0,8,0,16,40,64,4,0,0,413
4500 Rem Character 95=_
4510 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4520 Data 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,18
4530 Rem Character 96
4540 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4550 Data 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4560 Rem Character 97=a
4570 Data 0,0,3,11,0,0,0,0,0,0,0,0,0,9,6,1,0,0
4580 Data 0,2,0,0,21,21,21,21,21,21,21,21,4,14,0,1,0,240
4590 Rem Character 98=b
4600 Data 0,64,65,126,6,0,9,0,0,0,0,0,0,0,9,0,6,0
4610 Data 0,1,0,126,0,10,0,17,17,17,17,17,17,17,0,10,4,0,555
4620 Rem Character 99=c
4630 Data 0,0,6,0,9,9,0,0,0,0,0,0,0,9,9,0,0,0
4640 Data 0,0,4,10,0,0,17,17,17,17,17,17,17,0,0,0,0,0,175
4650 Rem Character 100=d
4660 Data 0,6,0,9,0,0,0,0,0,0,0,9,65,68,126,1,0,0
4670 Data 0,4,10,0,17,17,17,17,17,17,17,0,8,2,126,0,1,1,555
4680 Rem Character 101=e
4690 Data 0,6,0,9,9,0,0,0,0,0,0,0,0,8,9,1,5,0
4700 Data 0,4,14,4,4,21,21,21,21,21,21,21,21,5,5,12,4,0,267
4710 Rem Character 102=f
4720 Data 0,0,0,0,0,63,0,64,64,64,64,64,64,64,0,32,0,0
4730 Data 0,16,17,17,17,63,81,17,17,16,0,0,0,0,64,0,0,0,868
4740 Rem Character 103=g
4750 Data 2,0,33,21,76,68,68,68,68,68,68,68,84,21,37,4,66,64
4760 Data 0,6,36,64,25,17,17,17,17,17,17,17,1,64,32,66,4,0,1301
4770 Rem Character 104=h
4780 Data 64,64,127,4,0,8,0,0,0,0,0,0,0,8,0,7,0,0
4790 Data 1,1,127,1,9,0,16,16,16,16,16,16,16,1,9,7,1,1,552
4800 Rem Character 105=i
4810 Data 0,0,0,0,0,0,0,0,47,0,0,0,0,0,0,0,0,0
```

```
4820 Data 0,0,0,0,0,1,17,17,95,1,1,1,0,0,0,0,0,0,180
4830 Rem Character 106=j
4840 Data 0,0,0,1,0,0,0,0,0,32,33,126,0,0,0,0,0,0
4850 Data 0,0,2,0,1,1,1,1,1,1,0,62,0,0,0,0,0,0,262
4860 Rem Character 107=k
4870 Data 0,64,64,127,66,66,0,0,6,6,0,0,9,9,0,0,0,0
4880 Data 0,1,1,127,1,1,4,4,0,0,27,27,17,17,17,17,0,0,678
4890 Rem Character 108=l
4900 Data 0,0,0,0,0,0,64,64,127,0,0,0,0,0,0,0,0,0
4910 Data 0,0,0,0,0,1,1,1,127,1,1,1,0,0,0,0,0,0,388
4920 Rem Character 109=m
4930 Data 0,0,15,0,8,0,0,0,8,7,0,8,0,0,0,15,0,0
4940 Data 17,17,15,9,1,16,16,16,9,7,9,0,16,17,17,15,1,1,260
4950 Rem Character 110=n
4960 Data 0,0,0,15,0,8,0,0,0,0,0,0,0,8,7,0,0,0
4970 Data 0,17,17,15,9,1,16,16,16,16,16,16,16,17,1,15,1,1,0,228
4980 Rem Character 111=o
4990 Data 0,6,0,9,9,0,0,0,0,0,0,0,0,9,9,0,6,0
5000 Data 0,4,10,0,0,17,17,17,17,17,17,17,17,0,0,10,4,0,212
5010 Rem Character 112=p
5020 Data 0,64,64,63,40,0,68,68,68,68,68,68,68,0,0,40,16,0
5030 Data 0,1,1,127,1,72,0,0,0,0,0,0,72,72,0,48,0,1157
5040 Rem Character 113=q
5050 Data 0,16,40,0,0,68,68,68,68,68,68,0,40,31,32,64,65,0
5060 Data 0,48,0,72,72,0,0,0,0,0,0,72,0,63,65,1,0,2,1091
5070 Rem Character 114=r
5080 Data 0,0,0,8,7,0,8,0,0,0,0,0,0,0,8,0,0,0
5090 Data 0,0,17,1,15,9,1,16,16,16,16,16,16,16,16,0,8,0,0,194
5100 Rem Character 115=s
5110 Data 0,9,5,1,0,0,0,0,0,0,0,0,0,0,8,10,9,0
5120 Data 0,11,16,20,21,21,21,21,21,21,21,21,21,21,5,1,26,0,331
5130 Rem Character 116=t
5140 Data 0,0,0,0,126,1,0,0,0,0,0,0,0,0,1,0,0,0
5150 Data 0,0,16,16,126,16,17,17,17,17,17,17,17,1,1,0,2,0,0,408
5160 Rem Character 117=u
5170 Data 0,0,0,14,1,0,0,0,0,0,0,0,0,1,0,14,1,0,0
5180 Data 0,16,16,30,16,17,1,1,1,1,1,1,16,18,30,16,17,1,230
5190 Rem Character 118=v
5200 Data 0,0,8,0,4,0,2,0,1,0,2,0,4,0,8,0,0,0
5210 Data 16,16,16,24,16,4,0,2,1,2,0,4,16,24,16,16,16,0,218
5220 Rem Character 119=w
5230 Data 0,0,14,1,0,1,0,2,4,2,0,1,0,1,14,0,0,0
5240 Data 16,16,30,16,17,0,2,4,8,4,2,0,17,16,30,16,16,0,250
5250 Rem Character 120=x
5260 Data 0,0,9,9,0,0,6,6,0,0,6,6,0,0,9,9,0,0
5270 Data 17,17,17,17,27,27,0,0,4,4,0,0,27,27,17,17,17,17,312
5280 Rem Character 121=y
5290 Data 1,64,64,64,97,64,18,0,12,0,8,0,16,64,96,64,64,64
5300 Data 2,1,1,65,0,34,0,20,0,8,0,16,0,32,0,64,0,0,1003
5310 Rem Character 122=z
5320 Data 0,8,1,1,0,0,2,2,0,0,4,4,0,0,8,8,1,0
5330 Data 0,25,17,17,19,19,17,17,21,21,17,17,25,25,17,17,19,0,349
5340 End

Sample output from the above program using a standard Star-Gemini 10
Character set: ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz
               01234567890!"£$%&'()<>=-+*/[_],.;:?#
```

BBC Cross-Reference Lister

MICROTEX 666

by Jagdish Sah

This program is available electronically through Microtex 666's software downloading service. It is accessed through Viatel page *66637#.

This machine code routine produces a cross-reference listing of a Basic program resident in memory. It makes use of the fact that the details of variables, PROCs, and so on, are stored as linked lists at LOMEM. The various items are divided into 10 groups: integer variables; real variables; string variables; integer arrays; real arrays; string arrays; PROCedures; FNs; system variables; and line-number references.

The details for the first occurrence of an item are stored in an 8-byte block like this:
byte 0–1 points to the next item
byte 2–3 points to its name
byte 4–5 points to its next value
byte 6–7 points to its current value
The information about subsequent occurrences is held in a 4-byte block:
byte 0–1 points to its next value
byte 2–3 points to its current value
Here, 'value' means the line number on which the item was found.

The program takes about 5–10 seconds to analyse a 10k program. After analysis, it gives you the option of outputting to printer or screen. The results are printed in groups after being sorted into alphabetical order. If, being displayed on the screen, they are shown in paged mode, you will need to hit Shift to bring up the next screen.

Type in the program as listed. Then type CALL &8C0 to analyse the program — this gives a cross-reference of the assembler section as well. To suppress this, use CALL &8C0,?0 to get labels only or CALL &8C0,?0,?0 to ignore the assembler section completely.

Disk users should not use *RUN to run the program, but *LOAD it and use the CALLs as given above. Whenever a line is printed with an * it shows that a label, PROC or FN is defined on that line. The routine will not work with Hi-Basic under the second processor.

```
10REM XREF
20REM By Jagdish Sah
30REM
40:
50start=&8C0
60PROCassemble:PROCcheck:IF S%<>chksum%:PRINT"Checksum error":END
70PRINT'"To save the machine code produced type"'
80PRINT"*SAVE XREFMC ";~start;" ";~P%'':END
90:
100DEF PROCassemble
110osbyte=&FFF4:osasci=&FFE3:osnewl=&FFE7:osrdch=&FFE0
120loaem=0:yline=&A:lineptr=&B:himem=6:page=&18:intA=&2A:varblk=&70
130lineno=&72:temp=&74:asmflg=&76:defflg=&77:linelen=&78:vartype=&79
140savey=&7A:index=&7B:ytemp=&7C:stack=&7D:intptr=&50:name=&601:name2=&680
150IF ?&8015=ASC("1"):RESTORE 1610:ELSE:RESTORE 1630
160READ detokenise,ptokens,chkprog,plineno,basic,chksum%
170:
180FOR pass=0 TO 2 STEP 2:P%=start:[ OPT pass
190JSR chkprog:LDA page:STA lineptr+1:LDA £0
200STA lineptr:STA asmflg:STA defflg:LDX £19
210.init STA intptr,X:DEX:BPL init:STX linelen:TSX:STX stack
220.mainloop LDY £1:STY yline:JSR getbyte
230BMI exitmain:STA lineno+1:JSR getbyte:STA lineno:JSR getbyte:STA linelen
240.lineloop JSR getnonspace:CMP £ASC("*"):BEQ exitline
250CMP £&F4:BEQ exitline:CMP £&DC:BEQ exitline:JSR asm:BCC exitstmt
260.statement JSR skipchars:JSR getvar:BCS exitstmt:JSR linkvar
270.exitstmt CMP £58:BEQ lineloop
280CMP £&8B:BEQ lineloop:CMP £&8C:BEQ lineloop:JSR getnonspace:BNE statement
290.exitline LDA linelen:CLC:ADC lineptr
300STA lineptr:BCC mainloop:INC lineptr+1:BNE mainloop
310.exitmain LDX £0
320.exitm2 LDA mes,X:JSR osasci:INX
330CPX £15:BNE exitm2:TXA:LDX £&FF:STX linelen:INX:STX index:INX:JSR osbyte
340.getyn JSR osrdch:CMP £27:BEQ exit:AND £&5F:LDY £2
350CMP £ASC("Y"):BEQ printeron:CMP £ASC("N"):BNE getyn:LDY £14
360.printeron JSR osasci:TYA:JSR osasci:JSR osnewl:JSR osnewl
370.results LDX index:CPX £20:BCS exit:JSR getvarblk
380BEQ nextgroup:JSR sort:JSR prntvar:JSR osnewl:LDA &FF:BMI exit
390.nextgroup INC index:INC index:BNE results
400.exit LDA £3:JSR osasci:LDA £15:JSR osasci:JMP basic
410.getbyte
420LDY yline:CPY linelen:BEQ getbyte2:INC yline:LDA (lineptr),Y:RTS
430.getbyte2 LDA £0:RTS
440.getnonspace JSR getbyte:BEQ getbyte2:CMP £32:BEQ getnonspace:RTS
450.skipchars CMP £ASC(""""):BNE skiphex
460.skipstring JSR getnonspace:BEQ exitskip:CMP £ASC(""""):BNE skipstring
470.skiphex CMP £ASC("&"):BNE exitskip
480.skiphex2 JSR getnonspace:CMP £ASC("0"):BCC exitskip:CMP £ASC("G")
490BCS exitskip:CMP £ASC("9")+1:BCC skiphex2:CMP £ASC("A"):BCS skiphex2
500.exitskip RTS
510.asm CMP £ASC("["):BNE asm2:INC asmflg:JSR getnonspace
```

```
520.asm2 LDY asmflg:BNE asm3:SEC:RTS
530.asm3 LDY &600:CPY £2:BCS asm6:CMP £ASC("."):BNE asm4:INC defflg
540JSR getbyte:JSR getvar:BCS asm6:JSR linkvar:DEC yline:JSR getnonspace
550.asm4 LDY &600:BNE asm6
560CMP £58:BEQ asm7:CMP £ASC("\"):BEQ asm6:CMP £ASC("]"):BEQ exitasm
570.asm8 JSR getbyte:CMP £ASC("Q"):BEQ asm8:JSR getbyte
580.asm5 JSR getnonspace:CMP £ASC("(")
590BEQ asm5:CMP £ASC("£"):BEQ asm5:JSR skipchars:JSR getvar:BCS asm6
600CPX £1:BEQ asm6:LDY name:CPY £ASC("A"):BEQ asm6:JSR linkvar
610.asm6 CMP £58:BEQ asm7:JSR skipchars
620CMP £ASC("]"):BEQ exitasm:JSR getnonspace:BNE asm6
630.asm7 CLC:RTS
640.exitasm DEC asmflg:CLC:RTS
650.getvar LDY yline:DEY:STY savey
660.getvar4 LDY £0:STY vartype:CMP £&80:BCS chkproc
670CMP £ASC("@"):BCC getvar2:CMP £ASC("z")+1:BCS getvar2
680CMP £ASC("Z")+1:BCC getvar3:CMP £95:BCS getvar3
690.getvar2 SEC:RTS
700.getvar5 STY vartype
710.getvar3 LDX £0
720.getv2 STA name,X:INX:JSR getbyte:CMP £ASC("0"):BCC getv3
730CMP £ASC("9")+1:BCC getv2:CMP £ASC("@"):BCC getv3
740CMP £ASC("Z")+1:BCC getv2:CMP £95:BCC getv3:CMP £ASC("z")+1:BCC getv2
750.getv3 LDY £0:CMP £ASC("%"):BEQ getv4:INY:CMP £ASC("$"):BNE getv5:INY
760.getv4 STY ytemp:STA name,X:INX:JSR getbyte:DEC yline:LDY ytemp
770.getv5 CMP £ASC("("):BNE getv8:INY:INY:INY
780.getv7 STA name,X:INX
790.getv8 PHA:LDA vartype:BNE getv6:STY vartype
800.getv6 LDA £0:STA name,X:PLA:CLC:RTS
810.chkproc LDY £6:CMP £&F2:BEQ getvar5:INY:CMP £&A4
820BEQ getvar5:LDY £9:STY vartype:CMP £&8D:BNE chksysvar:DEC yline
830JSR detokenise:LDY intA+1:STY name:LDA intA:LDX £1:BNE getv7
840.chksysvar DEC vartype:LDX £1:CMP £&B8:BNE sysvar2
850STA name:JSR getbyte:CMP £ASC("P"):BEQ getv7:DEC yline
860.sysvar2 DEX:CMP £&8F:BCC sysvar3:CMP £&D4:BCS sysvar3
870CMP £&94:BCC getv7:CMP £&CF:BCC sysvar3:AND £&BF:BNE getv7
880.sysvar3 CMP £&DD:BNE sysvar4:INC defflg
890.sysvar4 SEC:RTS
900.movename LDX £0
910.moven2 LDA name,X:STA name2,X:BEQ moven3:INX:BNE moven2
920.moven3 TXA:BEQ moven2:RTS
930.getname LDA lineptr:PHA:LDA lineptr+1:PHA
940LDA yline:PHA:LDY £2:LDA (varblk),Y:STA lineptr:INY:LDA (varblk),Y
950STA lineptr+1:LDY £0:STY yline:JSR getbyte:JSR getvar4:PLA:STA yline
960PLA:STA lineptr+1:PLA:STA lineptr:RTS
970.linkvar PHA:JSR movename
980LDA vartype:ASL A:TAX:JSR getvarblk:BNE linkv2:LDA lomem:STA intptr,X
990STA varblk:LDA lomem+1:STA intptr+1,X:STA varblk+1
1000.newblk LDY £1:LDX £8:JSR inclomem
1010LDA lineptr:CLC:ADC savey:STA (varblk),Y:INY:LDA lineptr+1:ADC £0
1020STA (varblk),Y:INY:INY:JSR setzero:BNE oldblk3
1030.linkv2 JSR getname:JSR compare
1040BEQ oldblk:JSR nextblk:BEQ newblk:BNE linkv2
1050.oldblk LDY £5:BNE oldblk2
1060.oldblk7 LDY £1
1070.oldblk2 JSR nextblk2:BNE oldblk7
1080INY:LDA (varblk),Y:TAX:INY:LDA (varblk),Y:DEY:DEY
1090AND £&7F:CMP lineno+1:BNE oldblk5:CPX lineno:BEQ oldblk6
1100.oldblk5 LDX £4:JSR inclomem
1110.oldblk3 LDA lineno:STA (varblk),Y
1120INY:LDA lineno+1:LSR defflg:BCC oldblk4:ORA £&80
1130.oldblk4 STA (varblk),Y
1140.oldblk6 PLA:RTS
1150.nextblk LDY £1
1160.nextblk2 LDA (varblk),Y:BEQ nextblk3
1170PHA:DEY:LDA (varblk),Y:STA varblk:PLA:STA varblk+1
1180.nextblk3 RTS
1190.inclomem LDA lomem:PHA:TXA
1200LDX lomem+1:CLC:ADC lomem:STA lomem:BCC inclomem2:INC lomem+1
1210.inclomem2 CMP himem:TXA:SBC himem+1:BCS noroom:TXA
1220STA (varblk),Y:PLA:DEY:STA (varblk),Y:STA varblk:STX varblk+1:LDY £1
1230.setzero LDA £0:STA (varblk),Y:INY:RTS
1240.noroom LDX stack:TXS:LDX £0
1250.noroom2 LDA mes2,X:JSR osasci:INX:CPX £11:BNE noroom2
1260LDX lineno:LDA lineno+1:STX intA:STA intA+1:JSR plineno:JMP exitmain
1270.compare LDA name:CMP name2:BNE compare3:LDX £1
1280.compare2 LDA name,X:CMP name2,X
1290BNE compare3:INX:CMP £0:BNE compare2
1300.compare3 RTS
1310.sort STA temp+1:LDA varblk:STA temp:JSR getname
1320.sort2 JSR movename
1330.sort3 JSR nextblk:BEQ exits2:JSR getname:JSR compare:BCS sort3:LDY £2
1340.swap LDA (varblk),Y:PHA:LDA (temp),Y
1350STA (varblk),Y:PLA:STA (temp),Y:INY:CPY £8:BNE swap:BEQ sort2
1360.exits2 LDA temp:STA varblk
1370LDA temp+1:STA varblk+1:JSR nextblk:BNE sort:LDX index
1380.getvarblk LDA intptr,X:STA varblk:LDA intptr+1,X:STA varblk+1:RTS
1390.prntvar PHA:LDA varblk:PHA:JSR getname
1400LDY £0:LDX £9:CPX vartype:BNE prntv2:JSR plineno+4:LDX £4:BNE prntv3
1410.prntv2 LDA name,Y:BEQ prntv3:JSR ptokens:DEX:INY:BNE prntv2
1420.prntv3 LDA £32:JSR osasci:DEX:BPL prntv3:LDY £6
1430.prntv4 LDA (varblk),Y:STA intA:INY:LDA (varblk),Y:PHA:AND £&7F
1440STA intA+1:STY savey:JSR plineno:PLA:BPL prntv6:LDA £ASC("*"):JSR osasci
1450.prntv6 LDY savey:DEY:DEY:JSR nextblk2
1460BEQ nextvar:LDA £ASC(","):JSR osasci:LDY £2:BNE prntv4
1470.nextvar JSR osnewl:PLA:STA varblk
1480PLA:STA varblk+1:LDA &FF:BMI prntv5:JSR nextblk:BNE prntvar
1490.prntv5 RTS
1500.mes OPT FNequb(&0D):OPT FNequs("Printer (Y/N)?")
1510.mes2 OPT FNequb(&0D):OPT FNequs("upto line-")
1520]:NEXT:ENDPROC
1530:
1540DEF FNequb(x%):?P%=x%:P%=P%+1:=pass
1550:
1560DEF FNequs(x$):$P%=x$:P%=P%+LEN(x$):=pass
1570:
1580DEF PROCcheck:S%=0:FOR J%=start TO P%-1:S%=S%+?J%:NEXT:ENDPROC
1590:
1600REM Basic-I entry points & checksum value
1610DATA &97AE,&B53A,&BE88,&98F1,&8A96,126988
1620REM Basic-II entry points & checksum value
1630DATA &97DF,&B50E,&BE6F,&991F,&8AF3,126434
```

Turbo Pascal Sideways Printing

by Mark Needham

This program prints a file sideways on an Epson-type printer. The characters are printed using the bit image mode of the printer (ESC K). To get the character definitions on an IBM-type computer, the program fetches bytes from the ROM at $fe00:1a6e; there are eight bytes for each of the characters 0 to 127 in the ROM. For other machines, or to define your own characters, put the definitions in a file to be called CHARDUMP.TXT. This should hold eight values for each of the characters 0 to 127 — 1024 numbers altogether.

The size of the characters can be modified: height and width can be changed, and you can specify the number of lines to fit on a page.

To define a character, use the procedure given in the diagram after the listing.

```
program SideWaysPrinter;   { SIDEPRNT.PAS }

type filedef = record b : char end;

var printfile                    : file of filedef;
    printrec                     : filedef;
    ptrs,lens                    : array[1..132] of integer;
    CharDef                      : array[0..127,0..7] of integer;
    LinesPerPage,Max,Chars,
    rows,m,p,loop,line,
    CharHeight,mode,count,width  : integer;
    CharFile                     : Text;
    codes                        : array[1..480] of byte;
    Key                          : char;
    Fname                        : string[20];
    Found                        : boolean;
    main                         : array[1..32767] of char;
```

```
procedure SendToPrinter(x : Integer);
var loop : integer;
begin
   write(lst,chr(27)+'K'+chr(x mod 256)+chr(x div 256));
   for loop := 1 to x do write(lst,chr(codes[loop])); count := 0;
end;

function MakeBits(V,m3 : integer) : integer;
var m1,m2,loop,ans : integer;
begin
  m1 := m3; m2 := 3; ans := 0;
  for loop := 1 to 4 do
  begin
    if (m1 and v)=m1 then ans := ans + m2;
    m1 := m1 shl 1; m2 := m2 shl 2
  end;
  MakeBits := ans
end;

procedure DoPrint(len : integer);    { Mode Values 0 normal, 1 Double Width }
var Height,NumBits,x,c,loop,bits : integer;
begin
  for loop := 1 to LinesPerPage do
    if ptrs[loop] <> 0 then if main[ptrs[loop]]=chr(26) then ptrs[loop] := 0;
  NumBits := 8*CharHeight;
  for x := 1 to len do
  begin
    for width := 1 to 2 do
    if (width=1) or ((width=2) and (mode<>0)) then
    begin
      count := 0;
      for loop := LinesPerPage downto 1 do
      begin
        if count+NumBits >= 480 then SendToPrinter(count);
        if (x > lens[loop]) or (ptrs[loop] = 0) then c:=32
        else c:=ord(main[ptrs[loop]+pred(x)]);
        for bits := 7 downto 0 do
         for height := 1 to CharHeight do
         begin
           count := succ(count);
           if width=1 then
           begin
             if mode=0 then codes[count] := CharDef[c,bits]
             else codes[count] := MakeBits(CharDef[c,bits],16)
           end;
           if width=2 then codes[count] := MakeBits(CharDef[c,bits],1)
         end
      end;
      if count <> 0 then SendToPrinter(count);
      write(lst,chr(13)+chr(10))
    end
  end; write(lst,chr(12))
end;

procedure GetFacts;
begin
  clrscr;
  gotoxy(1,1);
  write('SIDEWAYS PRINTER PROGRAM - By Mark Needham (May 1986).');
  repeat
    Found := false;
    gotoxy(1,3); write('Character Set from (F)ile or IBM (R)om ? ');
    repeat read(kbd,key); key := Upcase(key) until (key='F') or (key='R');
    case key of
    'F' : begin
            assign(CharFile,'Chardump.txt'); {$I-} reset(CharFile) {$I+};
            if IOresult=0 then
            begin
              gotoxy(1,5); write('LOADING CHARACTER SET FROM FILE ');
              for Chars := 0 to 127 do
                for rows := 0 to 7 do readln(CharFile,CharDef[Chars,rows]);
              close(CharFile); Found := true
            end else write(#7)
          end;
    'R' : begin
            gotoxy(1,5); write('LOADING FROM ROM '); Found := true;
            for Chars := 0 to 127 do
              for rows := 0 to 7 do
                CharDef[Chars,rows]:=Mem[$fe00:$1a6e+Chars*8+rows]
          end
      end
    until Found;
    repeat
      CharHeight := 1;
      gotoxy(1,7); write('Enter Height 1=Normal, 2=Double (Default = 1) ? ');
      readln(CharHeight)
    until CharHeight > 0;
    repeat
      LinesPerPage:=0;
      gotoxy(1,9); write('Enter Number of Lines Per Page (Default = 60) ? ');
      readln(LinesPerPage);
      if LinesPerPage = 0 then LinesPerPage := 60
    until (LinesPerPage > 0) and (LinesPerPage < 133);
    repeat
      mode := 0;
      gotoxy(1,11); write('Enter Width 0=Normal, 1=Double  (Default = 0) ? ');
      readln(mode)
    until (mode = 0) or (mode = 1);
    repeat
      gotoxy(1,13); write('Enter Name of File to Print ? '); readln(Fname);
      assign(PrintFile,Fname); {$I-} reset(PrintFile) {$I+};
      Found := (IOresult = 0); if not found then write(#7)
    until Found;
    close(PrintFile);
    gotoxy(1,15); write('Printing : ',Fname,', at ',CharHeight,' Height, ');
    write('and ',LinesPerPage,' Lines Per Page.');
    gotoxy(1,17); write('Press ENTER to Confirm or "C" to Change ? ');
    repeat read(kbd,key); key := Upcase(key) until (key = #13) or (key = 'C');
    writeln
  end;

  begin
    repeat GetFacts until key = #13;
    gotoxy(1,19); write('PRINTING FILE - PLEASE WAIT ');
    assign(PrintFile,Fname); reset(PrintFile); seek(PrintFile,0);
    write(lst,chr(27)+'1');
    max := 0; for p := 1 to 132 do begin ptrs[p] := 0; lens[p] := 0 end;
    ptrs[1] := 1; loop := 1; line := 1; m := 0;
    repeat
      read(PrintFile,PrintRec);
      if printrec.b = chr(13) then
      begin
        read(printFile,printrec);  { skip line feed character }
        lens[line] := m;
        if m > max then max := m;
        m := 0; line := succ(line); ptrs[line] := loop; {remember start of line}
        if pred(line) = LinesPerPage then
        begin
          DoPrint(Max);
          for p := 1 to 132 do begin ptrs[p] := 0; lens[p] := 0 end;
          ptrs[1] := 1; loop := 1; line := 1; max := 0;
        end
      end
      else begin main[loop]:=printrec.b; m:=succ(m); loop:=succ(loop) end
    until eof(PrintFile);
    if m <> 0 then begin lens[line] := m; if m > max then max := m end;
    close(PrintFile);
    if line <> 1 then DoPrint(Max);
    write(lst,chr(27)+'@'+chr(13)+chr(10))
  end.
```

Evolver

by T Hartley

MICROTEX 666

This program is available electronically through Microtex 666's software downloading service. It is accessed through Viatel page *66637#.

"The article by Ian Davies in the March 1986 issue of *APC*, (page 145), prompted me to consider the potential of these machines to generate complex output following a simple input. The approach taken by Davies was to pose the problem in such a way that the program had to search for a machine that could do a reasonable job of matching its output to a string of characters that had been previously defined by the user. It was in part a program that learnt from its

mistakes and was thereby an illustration of how 'mindless' guesses could approach the task of code copying/generation. Given enough time it would eventually achieve this aim.

It appeared to me that perhaps there was an alternative and equally valid way in which random organisations of finite state machines could be derived to illustrate 'evolutionary' behaviour. As a clinical biochemist I am familiar with the concept of hormonal responses that the higher animals use to deal with a variety of environmental stimulae. For the non-biochemist probably one of the most well known hormonal responses is the release of insulin from the pancreas when the blood glucose concentration starts to rise after a meal. In a person with diabetes inadequate amounts of insulin are released under these circumstances. If they are left untreated then they lose glucose in their urine and the high glucose concentration in their blood stream eventually damages vital tissues. The reason for citing such an example is that if one analyses the input and output relationship between the blood glucose concentration, the pancreas and the release of insulin then one realises that a very humble compound, glucose, which has a molecular weight of only 180, results in the release of a remarkably complex protein, insulin, which is composed of a fixed sequence of 51 amino acids and has a molecular weight of 6500.

If we regard the pancreas as the machine then it has responded to a simple chemical input by producing a highly organised and complex chemical output. This led me to develop my program which, instead of setting the finite state machines a sequence matching task, the user can stimulate the output by entering at any point and then sitting back to observe the complexity of its output. How then do I justify it as an illustration of evolutionary behaviour? My answer is that in evolutionary terms the most successful creatures are distinguished by the complexity and harmonisation of their biochemical responses to simple stimulae. Hence the machines that produce the most unique and complex output are, on such a criterion, the more highly evolved.

The program, Evolver, sets up a 5 × 5 array of finite state machines with a format identical to that shown in Fig 2 of Davies' article. Lines 80 to 220 allocate to each cell of the array a randomly selected output/coordinate, line 110, and a randomly selected 'next state'/coordinate. Hence if cell A,2 contains 3D then the initial entry of the 'stimulus' at this point would result in the machine outputting a '3' and then moving to the state shown in the cell with the coordinates D,3. The remainder of the program provides the interface with the user:

- Lines 240-320 print out the complete array.
- Lines 340-420 permit the user to select the entry coordinates.
- Lines 430-530 print out the first 64 digits produced by the machine following the entry at the user specified coordinates.
- Lines 570-590 permit the user to score the sequence of digits produced by the particular machine under evaluation.

On average most machines produce a sequence of four to six digits before either they start to repeat the sequence or alternatively fall into a trivial oscillation. From time to time, however, the program produces a fairly remarkable output from a machine such as that shown in Fig 1. When this machine is 'stimulated' at A,2 then the output is:

311144034101440341014403-
4101 . . . . . .

This machine scores 12 because it does not start to repeat itself until the 13th output. In fact the full sequence does not repeat but just the last eight digits of the initial sequence of twelve digits. In comparison stimulus at 0,A produces a trivial output:

424242424242424242424-
24242 . . . . . .

Another biochemical analogy relevant to the complexity of the output is that hormones and other special proteins frequently have relatively short sequences of amino acids at specific points along their length which confer upon them their special properties, for example: the ability to bind to certain receptor sites on the membranes of cells in a particular organ. These unique sequences are often at the ends of the amino acid chains, the so called terminal sequences, hence the output

311144034101

in the example above could be regarded as corresponding to a highly reactive/important terminal sequence = 3111 followed by a characteristic but more structural sequence = 44034101. To extend the analogy further, and accommodate all the amino acids commonly found in proteins, it would be necessary to create a 22 × 22 matrix and assign each random output between 0 and 21 to a particular amino acid, for example 0 = valine, 1 = tryptophan etc. To complete the study, a library of known amino acid sequences of biologically important proteins and peptides could be added so that every output from the experiments could be checked for coincidence and hence detect if a particular machine has 'randomly' stumbled upon the amino acid sequence for insulin, angiotensin, growth hormone... To run such a program written in Basic would, to quote from Davies' article, "... take some time before producing results — if necessary leave it for a while."

Technical Notes:
The program Evolver was written in SSBasic on an Exidy Sorcerer.

```
10 REM EVOLVER : A PROGRAM THAT PRODUCES A RANDOM ARRAY OF
20 REM FINITE STATE MACHINES FOR THE USER TO EXAMINE THE
30 REM COMPLEXITY OF THEIR PERFORMANCE.
40 REM T F HARTLEY, LARGS BAY, SA 5016;
50 CLEAR 1000
60 DIM OP$(5,5), ST$(5,5)
70 REM SET UP THE RANDOM 5 X 5 ARRAY OF MACHINES
80 FOR R = 0 TO 4
90 REM
100 FOR C = 0 TO 4
110 OP = INT( 5 * RND(5)) : REM OP = OUTPUT
120 ST = INT( 5* RND(5)) : REM ST = STATE
130 OP$(R,C) = STR$(OP)
140 IF ST = 0 THEN NS$ = "A" : GOTO 190
150 IF ST = 1 THEN NS$ = "B" : GOTO 190
160 IF ST = 2 THEN NS$ = "C" : GOTO 190
170 IF ST = 3 THEN NS$ = "D" : GOTO 190
180 NS$ = "E"
190 ST$(R,C) = NS$
200 NEXT C
210 REM
220 NEXT R
230 REM
240 REM PRINT OUT THE 5 X 5 ARRAY OF MACHINES
245 CH = 65
250 FOR R = 0 TO 4
255 PRINT CHR$(CH + R); "  ";
260 REM
270 FOR C = 0 TO 4
280 PRINT OP$(R,C); ST$(R,C);
290 NEXT C
300 REM
310 PRINT
320 NEXT R
330 REM
```

```
340 REM EXAMINE THE OUTPUT OF THE MACHINES FOLLOWING ENTRY
341 REM AT A POINT SPECIFIED BY THE USER
350 INPUT "ANY COLUMN NUMBER ... 0 -> 4 "; IP
360 INPUT "ANY ROW LETTER ..... A -> E "; R$
370 IF R$ = "A" THEN J = 0 : GOTO 430
380 IF R$ = "B" THEN J = 1 : GOTO 430
390 IF R$ = "C" THEN J = 2 : GOTO 430
400 IF R$ = "D" THEN J = 3 : GOTO 430
410 J = 4
420 REM
430 FOR N = 1 TO 64
440 PRINT OP$(J,IP);
450 TI = IP
460 IP = VAL(OP$(J,IP))
470 S$ = ST$(J,TI)
480 IF S$ = "A" THEN J = 0 : GOTO 530
490 IF S$ = "B" THEN J = 1 : GOTO 530
500 IF S$ = "C" THEN J = 2 : GOTO 530
510 IF S$ = "D" THEN J = 3 : GOTO 530
520 J = 4
530 NEXT N
550 REM
560 PRINT
570 INPUT "SCORE FOR THIS MACHINE..."; SC
580 IF SC>BS THEN BS = SC : BS$ = R$ + STR$(IP)
590 PRINT "BEST SCORE = "; BS; " ENTERED AT "; BS$
600 PRINT
610 GOTO 250
```

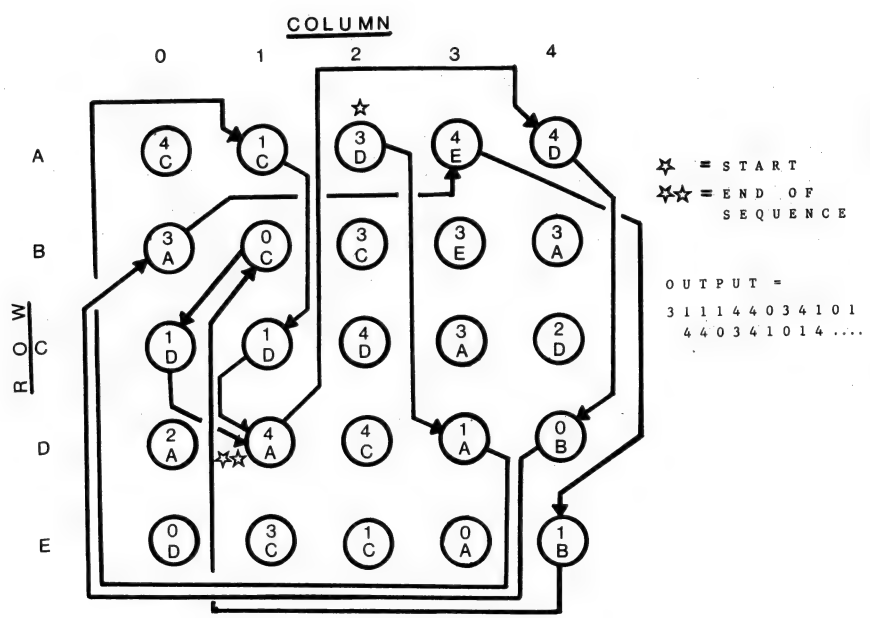

Figure 1

APC is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer.

Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number. Check through the previous Program listings to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications. Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in).

All programs should be fully debugged and your own original, unpublished work. We prefer to receive programs with a maximum 80-column width printed in emphasised typeface.

We will try to return submissions if they are accompanied by a stamped addressed envelope of the appropriate size, but please keep a copy of everything. Programs are paid for at the rate of $20 per page of published listing.

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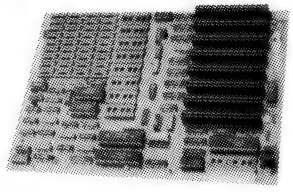

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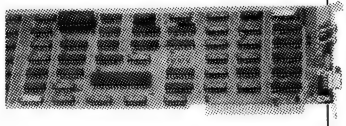

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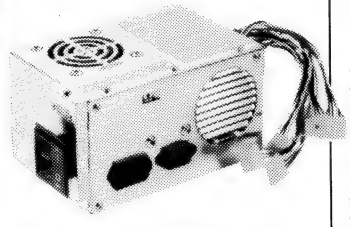

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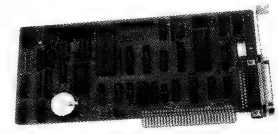

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- 1 serial port, 1 parallel port
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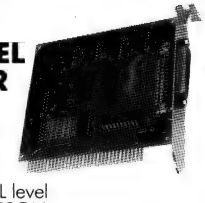

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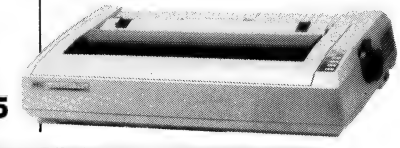

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CHIP CHAT

These people are serious . . . there are times when paranoia just seems like reasonable caution in the face of the facts. Paranoia is, we fear, the only reaction to the wild-eyed fanatics of International Resources Development Inc.

We have told you here before about this company's crazed views on AIDS, rectal (or even retinal) pattern recognition, and how we can all be aquanauts mining our nodules from computerised bubbles on the sea bed. But now IRD's pontifications are increasing in frequency, well beyond the average dose for an adult. One a month is amusing. Three a week is persecution.

For instance, IRD's Peter Kibler, obviously another in the long line of banana-heads at the company's Norwalk, Connecticut, HQ, says that if it weren't for batteries, 'our lifestyle might be closer to that enjoyed by our 19th-century counterparts than we enjoy today.' And if it weren't for fire, oddly enough, our lifestyle might be closer to that of the Stone Age than the 19th century, but that's by the way.

'Younger people have a more positive perception of batteries and battery-operated appliances than do older people,' says Kibler, digging himself deeper. 'Batteries simply work better today that they did in the past.'

The conclusion, from Kibler's 215-page report, is that people buy a lot of batteries and that the Japanese want a bigger share of the market. We stand amazed.

But hardly has the dust settled from Kibler's back-side hitting the pavement than another IRD pronouncement flutters through the transom.

'Health care for the elderly, in particular, will be increasingly dominated by the use of prostheses and artificial organs,' says our old burbling pal Mark Pine (he of the aquatic astronauts). 'Literally, we may be talking about factory-installed kidneys in just a few years time. Very, very specialised surgeons actually operating on an assembly line, handling hundreds of thousands of patients per day.'

But until we reach this Nirvana, Pine sees some lean years ahead with a need for prosthesis companies to diversify. 'A particular conspicuous example of this trend is supplied by Thoratec, an artificial heart company, whose Bion-II plastic material is expected to become the chief competitor in the performance textile market,' whatever a 'performance textile' may be.

And Christiaan Barnard's line of Glycel cosmetics, based on chemical materials developed to aid healing after transplants, is another example. 'If Christiaan Barnard — a name synonymous with heart transplants — can sell eye cream for $75 an ounce, perhaps some day we'll see charismatic Willian DeVries figuring in an ad for ski clothing!' concludes Pine impenetrably.

And perhaps some day we'll find Kibler and Pine running a double act at the local circus. Form a queue for the tomatoes.

(PS — IRD's public relations person is called Suzanne Bores. We just thought you'd like to know that.)

Sheer Kahn . . . ChipChat's peaceful existance was disturbed recently when Philippe Kahn, larger-than-life founder of cheap software pioneer Borland International, crashed into

our life with his usual delicacy and tact — that is, with none of those desirable qualities at all.

In a hotel room crammed with Compaqs, boxes of software opened and scattered on every surface, and a dozen empty litre bottles of Perrier, Kahn prowled around looking very, very big and very, very tired. And sprawled in an armchair with his eyes constantly drooping, he laid out his philosophy of the software world.

On Turbo Prolog, the follow-up to the Turbo Pascal phenomenon: 'For our next language we could have done C, we could have done Modula, we could even have done an assembler. But we thought the users needed a surprise, something to expand their imaginations.'

On artificial intelligence: Everybody talks about it but nobody does it, like sex I guess. People wanna build expert systems, to program them like they write a spreadsheet. Spreadsheets are programming tools too.'

On Sidekick, his pop-up utility package: 'The beauty of Sidekick is the notepad -- we managed to figure out a way of getting people to buy a second word processor.'

On pop-up programs in general: 'There are limits to what you can cram in RAM. There's no point in having an 80 or 90k program sitting in memory when you only use it every three days.'

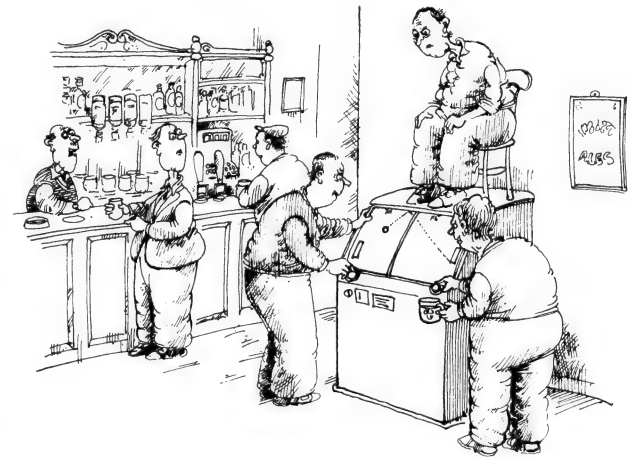
On marketing: 'It's like war, with several generals fighting it out. There are various tactics you can use, techniques like guerilla warfare, flank attacks and circling manoeuvres. And the army with the most troops doesn't win all the time.'

On PC users: 'There are 50 per cent who don't like the machine they're using. There are another 50 per cent who are interested and want to know more, and of those, 10 per cent get to be real hackers. That 10 per cent are the people who everyone goes to for advice, the gatekeepers for the rest of the users. And if you can convince them you've got a good product, they will pass the word.'

On future products: 'Graphics and communications are two areas that are not very satisfying right now. If you've used any graphics or comms products, you'll know what I mean.'

And on Borland strategy: 'We're only going to produce non-useful things from now on But people will buy them anyway.'

With that, Kahn's eyelids drooped further and he doubtless began dreaming of $25 million sales, $8 million profit, and lots of new shareholders with money to burn. END



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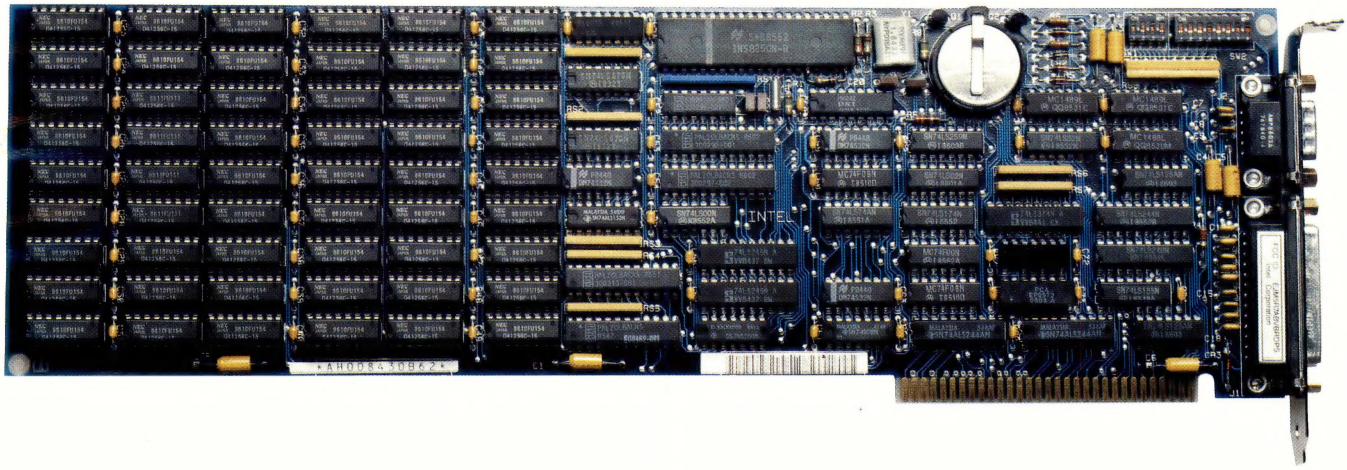

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